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INSTALLATION RESTORATION PROGRAM (IRP)
BASEWIDE QUARTERLY GROUND-WATER MONITORING
FIRST SEMIANNUAL REPORT

VOLUME 1: REPORT

Naval Air Station Fort Worth
Joint Reserve Base, Carswell Field
Fort Worth, Texas

March 1996

Final

PREPARED FOR

AIR FORCE BASE CONVERSION AGENCY (AFBCA/OL-H)
NAVAL AIR STATION FORT WORTH JOINT RESERVE BASE, CARSWELL FIELD
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UNITED STATES AIR FORCE
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March 11, 1996

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Subject: **Final First Semiannual Report**
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Dear Mr. Rice:

Law Environmental, Inc., is pleased to submit the enclosed nine copies of the Final First Semiannual Report of the Basewide Quarterly Ground-Water Monitoring, to the Air Force Center for Environmental Excellence (AFCEE).

If you have questions or comments, please contact us at (770) 499-6800.

Sincerely,

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FINAL

INSTALLATION RESTORATION PROGRAM (IRP) BASEWIDE QUARTERLY GROUND-WATER MONITORING FINAL FIRST SEMIANNUAL REPORT

FOR

NAVAL AIR STATION FORT WORTH
JOINT RESERVE BASE, CARSWELL FIELD
FORT WORTH, TEXAS 76127-5000

MARCH 1996

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LAW ENVIRONMENTAL, INC. (LAW), UNDER THE AIR FORCE INSTALLATION RESTORATION PROGRAM (IRP), IS CONDUCTING A BASEWIDE QUARTERLY GROUND-WATER MONITORING PROGRAM AT THE NAVAL AIR STATION FORT WORTH JOINT RESERVE BASE, CARSWELL FIELD. THE MONITORING PROGRAM CONSISTS OF SAMPLE COLLECTION AND LABORATORY ANALYSIS FOR 70 EXISTING MONITORING WELLS IN FOUR QUARTERLY EVENTS WITH REPORTS GENERATED SEMI-ANNUALLY.

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LIST OF ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
ARAR	applicable or relevant and appropriate requirement
CAD	computer aided design
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DNAPL	dense, nonaqueous phase liquid
EDD	electronic data deliverable
gpd/ft	gallons per day per foot
gpm	gallons per minute
IDW	investigation derived waste
IRP	Installation Restoration Program
LAW	Law Environmental, Inc.
LCS	Laboratory Control Samples
LENL-P	Law Environmental, Inc., National Laboratories - Pensacola
LIMS	laboratory information management system
LNAPL	light, nonaqueous phase liquid
MCLs	maximum contaminant levels
MDL	method detection limits
MS/MSD	matrix spike/matrix spike duplicate
MSC	maximum specific concentrations
msl	mean sea level
NAS	Naval Air Station
NCP	National Contingency Plan
PID	Photoionization Detector
POL	petroleum, oils, and lubricants
PVC	polyvinyl chloride

LIST OF ACRONYMS AND ABBREVIATIONS
(continued)

PQL	Practical Quantitation Limit
QA/QC	quality assurance/quality control
RPD	relative percent difference
SARA	Superfund Amendments and Reauthorization Act of 1986
SOP	standard operating procedures
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TNRCC	Texas Natural Resource Conservation Commission
TOC	top of casing
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
WBV	well bore volumes
μg/L	micrograms per liter

Quarterly ground-water sampling was conducted at NAS Fort Worth in April and July of 1995. Seventy monitoring wells were included in the investigation. The objective of the program was to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a basewide scale.

As part of the field sampling procedures, water level measurements were collected over a three-day period in an effort to provide representative ground-water elevations. Ground-water samples were collected and shipped to an off-site laboratory for analysis. The analytical data were evaluated compared to quality control criteria. Overall, the data quality was sufficient to identify the nature of contamination at the monitoring wells sampled. The samples collected were considered to be representative of the ground water at the sampling locations. The ground-water elevation data were used in development of maps as a means of depicting the ground-water surface during each of the two quarterly sampling events.

Based on the distribution of the monitoring wells, the ground-water flow was determined for 4 zones present on the base. The direction of ground-water flow is from southwest to northeast in the southwestern corner of the study area; from west to east in the north-central, south-central, and eastern portions of the study area; and from northwest to southeast in the southeastern portion of the study area. There is insufficient information to determine the ground-water flow direction in the northern portion of the study area.

Ground-water samples were analyzed for volatile organic compounds, semi-volatile organic compounds, total metals, and pesticides/PCBs. A single sample required pesticide/PCB analysis. The chemical data were compared to the Applicable or Relevant and Appropriate Requirements (ARARs). The ARARs used for data comparison were USEPA Maximum Contaminant Levels (MCLs) and Texas Natural Resource Conservation Commission (TNRCC) Medium-Specific Concentrations (MSCs). Based on these comparisons, maps indicating the location and concentration of contaminants exceeding ARARs were generated. Contaminant plumes were depicted in areas of sufficient data.

The nature of the contaminants detected on the base consisted primarily of volatile organics and metals. Due to the distribution of the monitoring wells and the erratic nature of the contaminant data, basewide trends were not apparent.

The highest concentrations of trichloroethene were detected at monitoring wells in the vicinity of Landfill 04 and Landfill 05. Benzene and total benzene, ethylbenzene, toluene and xylenes (BTEX), were reported in the vicinity of the POL Tank Farm, the Base Service Station, and Building 1628. Other volatile organic compounds reported with concentrations exceeding ARARs include: cis-1,2-dichloroethene, tetrachloroethene, vinyl chloride, styrene, and methylene chloride. No basewide trends were identified for the presence of volatile organic compounds in ground water across the base.

Total lead was detected near Building 1027 and Building 1628, and in the vicinity of the POL Tank Farm. Other metals reported with concentrations exceeding ARARs include: arsenic, barium, beryllium, cadmium, chromium, and nickel. No basewide trends were identified for the presence of metals in ground water across the base.

Bis(2-ethylhexyl)phthalate was detected above its ARAR concentration in two samples collected during the second quarter sampling event. This data may be the result of contamination introduced during sample collection or processing. No detections of pesticides or PCBs were reported.

1.0 INTRODUCTION

Law Environmental, Inc., (LAW) was contracted by the U.S. Air Force (USAF) Center for Environmental Excellence (AFCEE) to perform basewide quarterly ground-water monitoring at the Naval Air Station Fort Worth Joint Reserve Base, Carswell Field, Fort Worth, Texas (NAS Fort Worth). The work was conducted in conjunction with the Installation Restoration Program (IRP). This report summarizes the first and second of four scheduled quarterly characterization efforts and includes 70 existing monitoring well locations. The objective was to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a basewide scale.

This report applies to sampling events conducted in April and July 1995. Well locations and analytical methods were selected by AFCEE based on the "Site-Specific Ground-Water Analyses Letter Report, Basewide Well Monitoring" (LAW, 1995b), dated March 10, 1995.

The references used in this report are listed in Appendix A. (Please note that all appendices are included in Volume III of this report.) The AFCEE Statement of Work for Basewide Well Monitoring at Carswell Air Force Base (AFB), Texas is included in Appendix B.

1.1 THE AIR FORCE INSTALLATION RESTORATION PROGRAM

The USAF IRP is designed to identify, confirm/quantify, and remediate problems caused by past management of hazardous wastes at Air Force facilities. The IRP serves as the basis for assessment and response actions at USAF installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as augmented and amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The objectives of the Air Force IRP are to assess past hazardous waste disposal and spill sites at Air Force installations and to develop remedial actions consistent with the National Contingency Plan (NCP) for those sites which pose a threat to human health and welfare or to the environment.

1.2 INSTALLATION DESCRIPTION

NAS Fort Worth is located in Tarrant County, Texas, approximately 6 miles west of Fort Worth, Texas (Figure 1-1). (Please note that all figures are included in Volume II of this report.) The base covers approximately 25,000 acres and includes a flightline area; operations buildings; warehouses; petroleum, oils, and lubricants (POL) tank farm; and base housing. The base is bounded to the north by Lake Worth, to the west by Air Force Plant 4, to the south by the community of White Settlement, and to the east by the West Fork of the Trinity River and the city limits of Fort Worth, Texas.

Carswell AFB began operations in 1942 and was operated by the Air Force as a Strategic Air Command Base. The base is currently undergoing realignment to become a joint reserve base.

The following discussion of the NAS Fort Worth environmental setting is derived primarily from the Installation Restoration Program Phase I Records Search Report (CH2M Hill, 1984). Information from that report is supplemented by information from the literature and from the general findings of studies conducted by the U.S. Army Corps of Engineers (USACE) (USACE, 1991) and Radian Corporation (Radian, 1986; 1991a).

1.2.1 Regional Setting

1.2.1.1 Physiography - The majority of NAS Fort Worth is located within the Grand Prairie section of the Central Lowlands Physiographic Province. This area is characterized by broad terraces sloping gently to the east, divided by westward-facing escarpments. The land is northwestern portion of NAS Fort Worth is within the Western Cross Timbers Physiographic Province which is characterized by rolling topography and a heavy growth of post and blackjack oaks (USACE, 1991).

1.2.1.2 Regional Hydrogeologic Setting - The following section summarizes the hydrogeologic aspects of the study area which influence the environment at NAS Fort Worth.

1.2.1.2.1 Geomorphology - The topography of the installation is fairly flat except for areas near Farmers Branch and the Trinity River. The land surface slopes gently northeast toward Lake Worth and east toward the West Fork of the Trinity River. Elevations range from a high of approximately 690 feet above mean sea level (msl) near the southwest corner of the installation to a low of approximately 550 feet above msl near the east side of the installation. The elevation of Lake Worth usually approximates the elevation of the dam spillway, 594 feet above msl (USACE, 1991).

The principal drainage feature for NAS Fort Worth is the West Fork of the Trinity River. Farmers Branch drains the southern portion of the installation and discharges into the Trinity River. A small portion of the north end of the base drains into Lake Worth (USACE, 1991).

1.2.1.2.2 Stratigraphy - The geology of NAS Fort Worth can be characterized as a blanket of Quaternary clastic units overlying Cretaceous bedrock. From youngest to oldest, the geologic units of interest are as follows:

- Quaternary Alluvium/Terrace Deposits
- Cretaceous Goodland Limestone
- Cretaceous Walnut Formation
- Cretaceous Paluxy Formation
- Cretaceous Glen Rose Formation
- Cretaceous Twin Mountains Formation

NAS Fort Worth is located on the relatively stable Texas shelf, west of the faulting associated with the Ouachita Structural Belt. No major faults or fracture zones have been mapped near the base. The regional dip of the rocks at NAS Fort Worth ranges from 35 and 40 feet per mile in an easterly to southeasterly direction.

1.2.1.2.3 Soils - The U.S. Department of Agriculture (USDA) Soil Conservation Service has identified four near-surface soil associations on or near NAS Fort Worth. The surficial soils of the installation are primarily nearly level to gently sloping clayey soils of the Sanger-Purves-Slidell and Aledo-Bolar-Sanger Associations. Less widely distributed are the clayey soils of the Frio-Trinity Association and the loamy soils of the Bastil-Silawa Association which occur on the floodplain and stream terraces of the West Fork of the Trinity River (USACE, 1991).

1.2.1.3 Ground Water - Five hydrogeologic units have been identified at NAS Fort Worth. These units, listed from most shallow to deepest, are as follows:

- An upper perched-water zone occupying the alluvial terrace deposits of the Trinity River
- An aquitard consisting of predominantly unsaturated limestone of the Goodland and Walnut Formations
- The Paluxy Aquifer
- An aquitard of relatively impermeable limestone in the Glen Rose Formation
- A major aquifer in the sandstone of the Twin Mountains Formation

Upper Zone - Perched ground water occurs in lenses within the coarse alluvial sand and gravel deposits along the Trinity River. These lenses are limited in lateral extent and are surrounded by low-permeability clays and silts. Ground water in the upper zone occurs at depths ranging from 7 to 13 feet. Annual ground-water table fluctuations are typically on the order of 5 feet (USGS, 1993). Recharge to the water-bearing deposits is from rainfall and infiltration in stream channels and drainage ditches.

In parts of Tarrant County near the Trinity River, the upper zone is developed for irrigation and residential use. The community of River Oaks, immediately east of NAS Fort Worth, formerly utilized supply wells developed in alluvial deposits at a location near the former Carswell AFB hospital. The wells were abandoned when Carswell AFB purchased the property for hospital construction. In general, ground water in the upper zone is not economical to develop due to the zone's limited distribution and susceptibility to surface/storm-water pollution (USACE, 1991).

Goodland/Walnut Aquitard - The perched water present in the alluvium is separated from the underlying aquifers by the low permeability limestone and shale of the Goodland Limestone and Walnut Formations. The aquitard consists of moist clay and shale layers interbedded with dry limestone beds. Although the Walnut Formation is primarily dry, drillers in the area have reported small amounts of water in the Walnut Formation, suggesting that ground water may move through the Walnut along bedding planes. A previous soil boring at Air Force Plant 4, immediately west of NAS Fort Worth, indicated that the Goodland Limestone had been completely eroded and only 3 feet of the Walnut Formation was present. It has also been reported that the upper zone and Paluxy formation are in contact at the eastern boundary of Air Force Plant 4, where both the Goodland and Walnut formations have been removed by erosion. In areas of similar erosion, water in the upper zone could come in contact with water in the Paluxy aquifer (USACE, 1991).

Paluxy Aquifer - The Paluxy aquifer is the shallowest bedrock aquifer beneath NAS Fort Worth. Water in the Paluxy normally occurs under confined conditions beneath the Goodland/Walnut aquitard except where the aquitard is absent due to erosion. The Paluxy Formation is divided into upper and lower sand members and the aquifer is likewise divided into upper and lower aquifers. The upper sand is fine-grained and shaley while the lower sand is coarser; therefore, most wells are completed in the lower section (USACE, 1991).

The Paluxy aquifer is recharged along outcrops west of NAS Fort Worth. Paluxy outcroppings also occur north of the base in the bed of Lake Worth. The lake bed represents a significant recharge source for the aquifer and creates a localized potentiometric high. Regional ground-water flow within the Paluxy is eastward, parallel to regional dip. Ground-water flow at NAS Fort Worth is influenced by the Lake Worth potentiometric high and by a potentiometric low induced by ground-water withdrawals by the community of White Settlement. This produces a generally southeasterly flow direction (USACE, 1991).

Transmissivities in the Paluxy aquifer range from 1,263 to 13,808 gallons per day per foot (gpd/ft), with an average of 3,700 gpd/ft. In Tarrant County, the Paluxy Formation ranges in thickness from 140 to 190 feet, with an average thickness of 160 feet. The actual water-bearing thickness in the NAS Fort Worth area probably approximates the formation thickness, but the aquifer is separated into two distinct water-bearing zones. In the vicinity of NAS Fort Worth, permeabilities range from 13 to 140 gpd/ft^2 (based on an approximate thickness for the aquifer of 100 ft.) Well yields from the Paluxy aquifer range from 10 to 480 gallons per minute (gpm) averaging approximately 100 gpm (USACE, 1991).

The Paluxy aquifer represents a significant source of potable ground water in the Fort Worth area. Communities adjacent to NAS Fort Worth, especially White Settlement, develop municipal water supplies from the Paluxy, as well as from the deeper Twin Mountains aquifer. As a result of extensive pumping, water levels in the Paluxy aquifer have declined significantly over the past several years. Water levels in the immediate NAS Fort Worth vicinity have not lowered to the same degree as in the Fort Worth area because the base does not produce water from the Paluxy (USACE, 1991).

<u>Glen Rose Aquitard</u> - Below the Paluxy Aquifer are the fine-grained limestone, shale, marl, and sandstone beds of the Glen Rose Formation. The thickness of the formation varies from 250 to 450 feet. Although the sands in the Glen Rose Formation yield small supplies to wells in Fort Worth and western Tarrant County, the relatively impermeable limestone behaves as an aquitard, restricting water movement between the overlying Paluxy aquifer and the underlying Twin Mountains aquifer (USACE, 1991).

Twin Mountains Aquifer - The Twin Mountains Formation is the oldest formation used for water supply in the NAS Fort Worth area. The formation consists of a basal conglomerate of chert and quartz, grading upward into coarse to fine grained sand interbedded with shale. The formation varies in thickness from 250 and 430 feet. The Twin Mountains aquifer is recharged along outcrops west of NAS Fort Worth. Water movement is eastward in the direction of regional dip. Like water in the Paluxy aquifer, the Twin Mountains aquifer occurs under unconfined conditions in the recharge area, becoming progressively more confined in the downdip direction (USACE, 1991).

The Twin Mountains aquifer is the principal aquifer in Tarrant County and yields large water supplies for municipal (including human consumptive) and industrial purposes. In Tarrant County, transmissivities in the Twin Mountains aquifer range from 1,950 to 29,700 gpd/ft, with an average of 8,450 gpd/ft. Permeabilities range from 8 to 165 gpd/ft^2, with an average of 68 gpd/ft^2 (USACE, 1991).

Ground-water withdrawals from the Twin Mountains aquifer, primarily for municipal water supply, have resulted in declining water levels. Between 1955 and 1976, the potentiometric surface of the aquifer dropped approximately 250 feet. Water quality in the Twin Mountains aquifer is acceptable for potable use throughout the Fort Worth area (USACE, 1991).

1.2.1.4 Surface Water - NAS Fort Worth is located within the Trinity River Basin immediately south of Lake Worth, a man-made reservoir on the Trinity River. A portion of the installation is drained by Farmers Branch, which discharges into the West Fork of the Trinity River just south of the cantonment area. Farmers Branch begins near the community of White Settlement and flows eastward. Immediately south of Air Force Plant 4, Farmers Branch flows under the runway through two large culverts (USACE, 1991).

Most of the installation's surface drainage is diverted through a series of storm drains and culverts. The water is in turn directed to oil/water separators and discharged to the West Fork downstream of Lake Worth. A small portion of the north end of the installation drains directly into Lake Worth.

1.2.2 Hydrogeologic Setting

This section summarizes the general site setting of NAS Fort Worth.

1.2.2.1 Geology - The majority of the base is covered by Quaternary terrace deposits of the Trinity River. The terrace deposits are composed of sand, silt, clay and gravels of variable thickness and lateral extent. These deposits are underlain by Cretaceous limestones. The uppermost limestone formation in the southeastern portion of the base is the Goodland Limestone. The Goodland Limestone is a chalky white fossiliferous limestone and marl, which outcrops approximately 200 feet east of the 1337 Storage Yard, in Farmers Branch. Beneath the Goodland Limestone is the Walnut Formation, a coquinoidal limestone with variable quantities of clay and shale. Underlying the Walnut Formation is the Paluxy Formation, a fine- to coarse-grained sand with minimal quantities of clay, sandy clay, pyrite, lignite, and shale. The regional dip of the rocks in the vicinity of NAS Fort Worth ranges from 35 to 40 feet per mile to the east and southeast.

1.2.2.2 Hydrogeology - The three uppermost hydrogeological units identified at NAS Fort Worth are as follows:

- A perched water zone occupying the Quaternary terrace deposits of the Trinity River
- An aquitard consisting of predominantly unsaturated limestone of the Goodland Limestone and Walnut Formation
- The Paluxy Aquifer

The Quaternary terrace deposits which form the perched-water zone are composed of sand, silt, clay, and gravel. Ground water is first encountered within the perched-water zone at depths ranging from approximately 5 to 15 feet below the ground surface. Annual ground-water fluctuations are typically on the order of 5 feet. Recharge to the perched-water zone is from rainfall and infiltration from stream channels and drainage ditches.

The perched-water zone in the Quaternary terrace deposits is separated from the underlying aquifers by the low-permeability limestone and shale of the Goodland Limestone and Walnut Formation. The thickness of the Goodland Limestone/Walnut Formation is approximately 25 feet or greater beneath most of the base. However, the tops of the formations are erosional surfaces and weathering may locally reduce the thickness of the formations. In areas of greater erosion, the Quaternary alluvium may be in contact with the Paluxy Formation.

The Paluxy Formation forms the shallowest bedrock aquifer beneath NAS Fort Worth. Ground water within the Paluxy Formation normally occurs under confined conditions beneath the aquitard of the Goodland Limestone/Walnut Formation, at depths of approximately 100 feet below ground surface (450 feet above mean sea level) along the eastern portion of the base. Extensive pumping of ground water in the Fort Worth area has lowered the potentiometric surface within the Paluxy Aquifer beneath the top of the formation, resulting in unconfined conditions of the aquifer in the area of NAS Fort Worth.

1.2.3 Climatology

NAS Fort Worth is located at approximately 33 degrees north latitude. The climate is humid subtropical with hot summers and dry winters. Tropical maritime air masses control the weather during much of the year; however, the passage of polar cold fronts and continental air masses create large variations in winter temperatures (USACE, 1991).

The average annual temperature for NAS Fort Worth is 66 degrees Fahrenheit and monthly mean temperatures vary from 45 degrees Fahrenheit in January to 86 degrees Fahrenheit in July (Table 1-1). The average daily minimum temperature in January is 35 degrees Fahrenheit and the lowest recorded temperature is 2 degrees Fahrenheit. The average daily maximum temperature in July and August is 95 degrees Fahrenheit and the highest temperature recorded at the base was 111 degrees in the month of June. On the average, freezing temperatures occur at NAS Fort Worth on 33 days per year (USACE, 1991).

TABLE 1-1

METEOROLOGICAL DATA SUMMARY
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
TEMPERATURE (°F)													
Mean	45	50	57	66	74	82	86	85	78	68	56	49	66
Average Daily Maximum	55	60	67	76	83	91	95	95	88	78	66	59	76
Average Daily Minimum	35	39	46	56	64	72	75	75	68	57	46	38	56
Highest Recorded	88	88	85	89	100	111	109	110	107	105	89	91	110
Lowest Recorded	2	6	11	31	42	55	61	60	46	33	17	11	2
PRECIPITATION (inches)													
Mean	1.7	1.9	2.1	3.9	4.2	3.1	2.5	2.1	3.6	3.1	1.8	1.9	31.9
Maximum Monthly	5.9	4.7	6.5	14.2	15.2	8.8	9.0	6.0	9.6	10.7	7.4	6.7	15.2
Minimum Monthly	0.1	0.1	(a)	0.8	0.8	0.1	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Maximum in 24 hours	2.8	3.2	3.4	3.3	5.7	3.5	5.9	3.1	4.0	3.2	2.8	2.9	5.9
Days with Thunderstorms	1	2	3	6	8	6	5	5	4	3	1	1	45
SNOWFALL (inches)													
Mean	2	1	6	0	0	0	0	0	0	0	(b)	(b)	3
Maximum Monthly	8	12	7	0	0	0	0	0	0	0	4	3	8
Maximum in 24 hours	5	8	7	0	0	0	0	0	0	0	4	3	8
RELATIVE HUMIDITY (%)													
Mean	62	61	61	64	68	64	58	60	65	65	63	62	63
SURFACE WINDS (knots)													
Mean	8	8	9	9	7	8	6	5	6	6	8	8	7
Maximum	50	63	69	64	68	65	56	54	80	45	54	58	80
Prevailing Direction	S	S	S	S	S	S	S	S	S	S	S	S	S

Source: United States Air Force, Carswell AFB, Texas. Period of Record: 1946-1978.
(a) = Less than 1/10 inch.
(b) = Less than 1 inch.

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Mean annual precipitation recorded at NAS Fort Worth is 32 inches. Typically the wettest month is May, with a secondary maximum in September. The period from November to March is generally dry with a secondary minimum in August. Snowfall accounts for a small percentage of the total precipitation between November and March, with an average, measurable snowfall of 3 inches per year. Lake evaporation at NAS Fort Worth is estimated to be approximately 57 inches per year. Evapotranspiration over land areas may be greater or less than lake evaporation depending on vegetative cover type and moisture availability. Average net precipitation is expected to be equal to the difference between average total precipitation and average lake evaporation, or approximately minus 25 inches per year (USACE, 1991).

Thunderstorm activity occurs at NAS Fort Worth an average of 45 days per year. The greatest number of these storms typically occurs between April and June. Hail may fall on two to three days per year. The maximum precipitation recorded in a 24-hour period is 5.9 inches (USACE, 1991).

Mean cloud cover averages 50 percent at NAS Fort Worth with clear weather occurring frequently during all months. Some fog is present on an average of 83 days per year. Wind speed averages 7 knots; however, a maximum of 80 knots has been recorded. Wind direction is predominantly from the south during all months (USACE, 1991).

1.3 REMEDIAL ACTIONS

A Phase I Records Search study was conducted to identify past waste disposal activities at NAS Fort Worth which may have caused environmental contamination and the migration of contaminants off of the base (CH2M Hill, 1984). After ranking each site for potential adverse environmental effects, further investigation was recommended for 11 sites on the base and the Weapons Storage Area west of the base.

The 12 sites were investigated in the Phase II Stage 1 confirmation and quantification study (Radian, 1986). These sites include landfills, fire department training areas, industrial areas, and spills. The on-base sites were concentrated in two areas, the Flightline Area and the East Area (Figure 1-2). The Phase II Stage 1 investigation was intended to determine the effect of past waste disposal activities at NAS Fort Worth including the magnitude and extent of contamination and its potential for further migration.

A Phase II Stage 2 Remedial Investigation was conducted to further detail the extent of existing contamination in the East Area (Radian, 1991a). This study focused on the hydrogeology and ground-water quality at Landfill 1, Unnamed Stream, POL Tank Farm, and the Base Service Station.

Data from Radian's 1991 Remedial Investigation were used in the selection of alternatives in a Feasibility Study conducted for 22 sites suspected of containing hazardous waste. Sites classed in Category II (requiring additional monitoring or work to assess the extent of current or future contamination) included the POL Tank Farm and the Unnamed Stream (Radian, 1991b).

A non-IRP investigation was conducted prior to construction at Building 1337-White House Communication, to determine if pesticide contamination posed an environmental concern (Maxim, 1991). No significant pesticide contamination was detected in the soil or ground water at that time; however, evidence of fuel-related contamination was detected in soil samples from two soil borings at this location.

A pilot test/treatability study has been recently completed by Engineering-Science, Inc., (ES, 1993) at the POL Tank Farm site to test the effectiveness of bioventing on the petroleum impacted soil.

Engineering-Science is in the process of modeling ground-water contamination at the POL Tank Farm area to evaluate if soil contamination is entering the ground water and to evaluate the risk of exposure from ground water in the area (ES, 1994).

International Technology Corporation is currently remediating trichloroethylene (TCE) contamination in the Landfill 4 and Landfill 5 area. The ground-water extraction and treatment system (i.e., recovery well) is designed for the removal of TCE in the uppermost aquifer in the Terrace Alluvium Deposits (IT, 1994).

2.0 PROJECT ACTIVITIES

The following sections describe the project activities conducted as part of the basewide quarterly ground-water monitoring program. The activities include procedures associated with the selection of the monitoring wells located at NAS Fort Worth, and the sampling and analysis of selected monitoring wells as part of the first and second quarter sampling events. Field activities, laboratory analysis, and data evaluation are described in this section. All work was performed in accordance with the "Final Sampling and Analysis Plan for Basewide Quarterly Ground-Water Monitoring at NAS Fort Worth" (LAW, 1995a).

2.1 PROJECT OBJECTIVES

The objective of the quarterly ground-water sampling and analysis program is to determine the configuration of the ground-water potentiometric surface, to assess variations of the ground-water flow directions, and to assess the extent of previously identified constituents of concern in the ground water on a basewide scale.

2.1.1 Monitoring Well Selection

Monitoring wells were chosen for inclusion in this study based on information gathered from reconnaissance of existing monitoring wells and review of available records to determine the number, location, and likely contaminants present in the wells. The results of the reconnaissance and records search of 82 existing wells were submitted under separate cover as the "Site-Specific Ground-Water Analyses Letter Report, Basewide Well Monitoring" (LAW, 1995b). This information was presented during the March 2 and 3, 1995, On-Board Review Meeting, held at NAS Fort Worth. The final list of 70 monitoring wells and the analytical parameters to be reported were agreed to by LAW, AFCEE, and the Air Force Base Conversion Agency (AFBCA).

Summary of Well Reconnaissance and Records Search - A reconnaissance of the existing monitoring wells at NAS Fort Worth, was performed between October 26 and 29, 1994. During this survey, 82 monitoring wells were located, observed for visible damage, and a sampling bailer was inserted into each well to verify that ground water could be collected. Monitoring well descriptions are summarized in Appendix C.

LAW's objectives for the monitoring well field reconnaissance were to:

- Locate and identify the monitoring wells.
- Observe and record the visible condition of each monitoring well.
- Measure the depth to ground water and total depth of each well, measure vapors emanating from the wellhead using a photoionization detector (PID) organic vapor analyzer, and check for sediment accumulation at the bottom of the well.
- Obtain a ground-water sample from each well using a bailer and observe any phase separation, difficulty of sample retrieval and turbidity, and measure/record the pH.

The well number on each monitoring well was identified and recorded along with the date and time of the reconnaissance. Accessibility to the well was noted, including overgrowth/vegetation, insect infestation, and the need for flightline clearance.

Information relating to the physical characteristics of each well was recorded, including flush mount/stick up type, amount of stick up, if any, and casing diameter. The visible condition of the grout collar and its ability to block the migration of surface water into the well was noted. Notes were made to indicate the presence of guard posts, an operable lock, vented cap, and dedicated sampling equipment.

An HNu hand-held organic vapor analyzer equipped with a PID was used to detect organic vapors inside the well casing. This measurement was taken immediately after the well cap was removed and prior to the water level measurement. The static water level and total depth of the well was measured using an oil/water interface probe. The probe was also used to determine if the bottom of the well was "soft" or "hard," which indicated whether sediment had collected in the bottom of the well.

Each monitoring well was checked for sampler accessibility using a Teflon bailer. The bailer was 1.66 inches in diameter by 36 inches long with a one-way ball valve. Only one bailer volume of water was removed from each well. Observations recorded included the degree of turbidity in the sample, any phase separation, the general color, and the presence of odors. A pH reading was taken using pH indicator paper.

Types of Data Collected in the Records Search

Information and details concerning well installation and construction procedure were reviewed in documents provided by NAS Fort Worth. Data obtained from the documents are summarized as follows:

- Well Locations and Groupings - Maps, tables, and text were reviewed for information on well locations and groupings, whether by IRP Site, Solid Waste Management Unit (SWMU), or facility.
- Borehole Summary - Well boring records were reviewed to obtain depth to top of rock, zone of termination (terrace deposits, shallow bedrock or Paluxy Aquifer), and total boring depth.
- Casing Details (Size, Material, Construction, and Fittings) - Monitoring well installation diagrams were reviewed for data on well casing materials and construction. Information collected includes casing material, diameter, grade, assembly method (whether glued or threaded joints) and stickup (the distance from ground surface to the top of casing).
- Screened Interval - Monitoring well installation diagrams and text summary tables were reviewed to determine screened intervals, referenced to the top of casing (TOC).

- Filter Pack - Monitoring well installation diagrams were reviewed for the depth of filter pack intervals, referenced to ground surface.

- Bentonite Seal - Monitoring well installation diagrams were consulted for bentonite seal intervals, referenced to ground surface.

- Survey - Survey information was obtained from text summary tables and monitoring well installation diagrams, and consists of ground surface and reference point elevations. Information was also gathered to verify that each well's reference point was the TOC.

The following additional criteria were used in selection of monitoring wells to be included in the basewide ground-water monitoring program:

- Well Locations and Groupings - This study does not include wells located on Air Force Plant 4, or within the runway area west of Taxiway 197. Therefore, any wells located in this flightline area were not considered for quarterly sampling. Also, several wells in close proximity to other selected wells were not chosen for the program.

- Well Protection - Wells exhibiting evidence of, or susceptibility to, the entry of surface water into the production zone, tampering, and structural damage were not considered for quarterly sampling.

- Access to Well - Some wells located in areas of difficult access (due to security or operational constraints) were not evaluated during the field reconnaissance.

- Product - The current or past occurrence of measurable free phase product (whether light, nonaqueous phase liquid [LNAPL] or dense, nonaqueous phase liquid [DNAPL]) disqualified a well from quarterly sampling, unless the well was deemed critical to the investigation based on other criteria.

2.2 FIELD ACTIVITIES

The Sampling and Analysis Plan (LAW, 1995a), describes the field activities and procedures to be used during the quarterly ground-water monitoring events. The following activities were performed during each field event:

- Collection of water level measurements to determine ground-water flow direction

- Collection of ground-water samples and transport to laboratory

- Disposal of investigation derived wastes

All field activities were performed by LAW personnel. The chemical analyses were performed by Law Environmental National Laboratories, located in Pensacola, Florida. The following sections describe the chronology and methodology of the field activities, Quality Assurance/Quality Control (QA/QC) procedures, and investigation derived waste (IDW) management for the first and second quarter sampling events at NAS Fort Worth.

2.2.1 Field Program for the First Quarter Sampling Event

The objectives of the field activities were to perform quarterly monitoring of 70 basewide monitoring wells at NAS Fort Worth in order to achieve the following:

- Establish ground-water flow directions by collecting ground-water level measurements

- Assess the extent of previously identified constituents of concern in the ground water on a basewide scale through ground-water sampling and analysis

At the completion of each field event, documentation was evaluated to assess the success of the sampling effort. Lessons learned and corrective actions for subsequent field efforts are discussed in the following sections.

2.2.1.1 Water Level Measurements - Water level measurements were recorded for each monitoring well using an electronic interface probe. The measurements were taken during the first 3 days of the sampling event, prior to purging and sampling the wells, in order to obtain representative ground-water elevations at a point in time. Table 2-1 presents the water level measurements and ground-water elevations for the first quarter sampling event.

TABLE 2-1

SUMMARY OF GROUND-WATER LEVELS AND ELEVATIONS FOR FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Monitoring Well	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft. msl)	Quarter 1 (April 1995) Ground-Water Level (ft)	Quarter 1 (April 1995) Ground-Water Elevation (ft)
LF01-1A	6964379.79	2301262.30	570.27	12.97	557.3
LF01-1C	6964570.37	2301174.14	560	16.01	543.99
LF01-1D	6964260.11	2301399.35	563.93	17.02	546.91
LF01-1E	6964710.02	2301098.23	562.25	15.39	546.86
LF04-4A	6960309.58	2295843.39	625.76	10.09	615.67
LF04-4B	6960344.86	2296285.37	619.9	19.35	600.55
LF04-4D	6960738.32	2296412.03	615.35	19.81	595.54
LF04-4E	6961012.29	2296410.62	618.54	23.14	595.4
LF04-4F	6961077.24	2296017.27	625.36	28.7	596.66
LF05-5C	6961716.52	2295987.93	608.68	10.62	598.06
LF05-5D	6961728.69	2295786.58	611.71	10.62	601.09
LF05-5G	6961607.55	2296622.04	615.39	20.8	594.59
WP07-10B	6961320.67	2296039.46	624.46	27.26	597.2
WP07-10C	6961551.78	2296048.17	617.24	20.07	597.17
FTO8-11A	6962330.04	2295898.98	608.22	11.42	596.8
FT08-11B	6962046.37	2295940.03	608.14	8.92	599.22
FT09-12A	6960568.13	2295413.09	635.66	16.29	619.37
FT09-12B	6960750.89	2295646.43	627.55	30.14	597.41
FT09-12C	6960642.28	2295709.68	628.05	31.07	596.98
SD13-01	6963365.39	2300590.43	573.24	12.51	560.73
SD13-02	6963471.4	2300634.34	573.39	15.2	558.19
SD13-03	6963353.03	2300673.84	571.54	11.51	560.03
SD13-05	6963890.4	2300754.46	571.4	8.84	562.56
SD13-06	6963183.34	2300951.06	557.66	9.92	547.74
SD13-07	6963200.73	2301022.29	556.3	16.53	539.77
ST14-01	6963286.05	2300092.59	575.89	13.29	562.6
ST14-02	6963520.58	2300063.60	575.64	11.34	564.3
ST14-03	6963830.32	2300017.03	576.6	NR	--
ST14-04	6963661.85	2300334.72	575.74	12.02	563.72
ST14-W05 *	6963734.09	2299085.40	593.75	7.88	585.87
ST14-W06 *	6963806.74	2299323.48	581.33	8.38	572.95
ST14-W07 *	6963600.96	2299371.50	579.98	10.33	569.65
ST14-W08 *	6964290.1	2299504.71	580.43	9.68	570.75
ST14-W09 *	6963444.97	2299531.70	575.51	7.15	568.36
ST14-W11 *	6964102.84	2299619.94	576.21	6.29	569.92
ST14-W13 *	6963827.31	2299719.71	574.35	7.31	567.04
ST14-W15 *	6963292.25	2299899.35	573.35	9.97	563.38
ST14-W16 *	6964189.71	2300093.65	573.46	7.42	566.04

TABLE 2-1

SUMMARY OF GROUND-WATER LEVELS AND ELEVATIONS FOR FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Monitoring Well	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft. msl)	Quarter 1 (April 1995) Ground-Water Level (ft)	Quarter 1 (April 1995) Ground-Water Elevation (ft)
ST14-W19 *	6963724.05	2300183.16	573.11	8.98	564.13
ST14-W20 *	6963983.62	2300288.82	573.44	8.51	564.93
ST14-W21 *	6963323.75	2300221.00	572.76	9.67	563.09
ST14-W22 *	6963743.94	2300972.45	571.16	9.75	561.41
ST14-W23 *	6962939.39	2300316.91	564.97	4.87	560.1
OT15C	6963421.07	2300982.78	567.87	8.25	559.62
P3A	6970359.08	2297661.10	604.77	10.7	594.07
P6A	6960114.88	2295214.14	632.45	9.62	622.83
T3	6968697.5	2300582.55	575.11	3.06	572.05
T4A	6963623.58	2297567.60	606.49	17.73	588.76
T7	6968757.3	2299167.55	604.88	17.57	587.31
MW-5	6965793.95	2300138.54	563.9	4.12	559.78
MW-7	6966018.4	2300064.16	567.88	7.99	559.89
MW-8	6965549.32	2300407.23	556.91	5.56	551.35
MW-9	6965991.2	2300348.98	560.3	6.5	553.8
MW-10	6965908.63	2300460.96	559.53	NA	559.53
MW-11	6965699.44	2300762.94	558.9	25.09	533.81
MW-12	6966165.08	2300102.06	560.38	5.51	554.87
LSA1628-1	6967935	2297798.40	601.67	10.1	591.57
LSA1628-2	6967957.56	2297868.90	601.93	10.07	591.86
LSA1628-3	6968007.63	2297794.00	601.71	9.73	591.98
BSSA	6965477.12	2300110.37	566.38	4.97	561.41
BSSB	6965775.79	2300068.92	569.73	9.52	560.21
GMI04-01M	6960881.81	2296711.57	NA	19.19	--
GMI22-01M	6965193.71	2297689.70	606.62	18.13	588.49
GMI22-02M	6966618.4	2296162.42	619.19	8.41	610.78
GMI22-03M	6966253.93	2298516.95	607.99	20.28	587.71
GMI22-04M	6967242.46	2297342.02	610.71	19.37	591.34
GMI22-05M	6966966.77	2299409.80	584.36	10.5	573.86
GMI22-06M	6966990.33	2298185.83	606.77	18.05	588.72
GMI22-07M	6969003.09	2298306.26	605.63	17.02	588.61
GMI22-08M	6970349.65	2299013.95	606.92	15.53	591.39

PREPARED/DATE: JLP 9/25/95
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NR = Not recorded
NA = Not available
* Top of casing elevations are based on information provided in September 1995. Other top of casing elevations were submitted in the Basewide Quarterly Ground-Water Monitoring Final Scoping Documents dated March 1995.

Locations are not surveyed and are considered approximate.

2.2.1.2 Ground-Water Sampling - The following sampling protocol was followed:

1. Floating Hydrocarbon and Static Water Level Measurement - An electronic interface probe was used to test for the presence of floating product and to measure the static water level. The probe was decontaminated before and after each measurement to minimize the potential for cross-contamination between wells.

2. Monitoring Well Purging - The wells were purged using a polyvinyl chloride (PVC) bailer until the water quality parameters (pH, specific conductance, and temperature) were stabilized and a minimum of three well bore volumes (WBV) had been removed. Stabilization of the parameters was defined as: pH within plus or minus 0.1 pH units, specific conductance within 5 percent, and temperature within plus or minus 1 degree Celsius over consecutive readings. The pH, temperature and specific conductance were measured and recorded at the initiation of purging, after each WBV, and after collection of the samples. If the well was purged to dryness before the removal of 3 WBVs, the volume removed was recorded and the well was allowed to recharge before collection of the sample. The following wells were purged to dryness before three well bore volumes could be removed: ST14-W21, ST14-W23, SD13-02, SD13-06, SD13-07, LF01-1D, LF04-4A, LF04-4B, BSSB, MW-5, MW-7, MW-11, GMI22-05M, and P6A.

   In the event free product was detected in the well, pH indicator paper was used to estimate the pH, and specific conductance and temperature were not measured. This precaution was taken to prevent contamination of the testing equipment. The presence of free product was determined based on the presence of strong petroleum odor and a sheen on the purge water.

3. Sample Collection - Wells were allowed to recharge to at least 80 percent of the original static water level and sampled with dedicated PVC bailers. Purging the wells with bailers resulted in an increase in the turbidity of the ground water. In order to reduce this effect, the wells were allowed to settle for a period of 2 to 4 hours after purging, before sample collection was initiated.

   Sample containers were filled in decreasing order of sample volatility. Vials collected for analysis of volatile organics were completely filled, leaving no headspace.

4. Sample Handling - All samples were collected in prelabeled, prepreserved containers. Sample preservation was confirmed in the field. All samples

were iced immediately upon collection and remained on ice until receipt by the laboratory. Documentation of sample custody was maintained from the time of collection. A copy of the chain of custody records is presented in Appendix D. All samples were shipped by overnight courier on the day of collection.

Field information and measurements were recorded in hard bound field notebooks. Copies of the ground-water sampling reports, included in Appendix E, provide the calculated purge volume and results of the field measurements for each well sampled.

2.2.1.3 Chronology of Field Work - The field activities for the first quarter ground-water sampling were performed from April 3 to April 15, 1995. During the collection of static water level measurements, it was discovered that well ST14-W14 was not plumb. The AFCEE team chief was contacted and a mutual decision was made to substitute well ST14-03 for ST14-W14. In addition, monitoring well LF01-1A was substituted for LF01-1F which could not be located.

One sample cooler arrived at the laboratory with contents above the recommended maximum temperature of 8 degrees Celsius. The affected samples were discarded at the laboratory and the wells (BSSA, BSSB, MW-7, SD13-01 and SD13-03) were purged and resampled on April 13, 1995, for semi-volatile organics and metals. Volatiles samples did not require resampling because they were shipped in a separate cooler that was received with contents within the acceptable temperature range for sample storage (2 to 8 degrees Celsius).

Samples were not collected at MW-10, LSA1628-1, LSA1628-2, and LSA1628-3 due to the presence of free product in the wells. MW-10 was not resampled because of its close proximity to other wells in the Base Service Station Area, including BSSA, BSSB, MW-7, MW-8, MW-9, MW-11 and MW-12. The wells associated with Building 1628 were resampled on May 31 and June 1, 1995. It was later decided by the AFCEE team chief that wells MW-10, LSA1628-1, LSA1628-2, and LSA1628-3 would be sampled in subsequent quarterly sampling events.

Table 2-2 summarizes the samples collected in relation to each monitoring well during the first quarter field event.

2.2.1.4 Field Quality Assurance/Quality Control - Quality control parameters are monitored through the assessment of data collected for the evaluation of precision, accuracy, representativeness, and completeness. Field quality control activities consisted of the following:

- Calibration of field equipment
- Collection of field duplicate samples and equipment blanks
- Decontamination of field equipment
- Recording of field measurements and duplicate measurements
- Documentation of field information and measurements in hard bound field notebooks
- Review of field documentation, chain of custody records, ground-water sampling reports, and other field records

Daily meetings were conducted by the site manager for the purpose of reviewing the field procedures and quality control activities with the field team. Any corrective actions necessary were discussed, documented, and implemented immediately. Changes to procedures described in the Sampling and Analysis Plan were first discussed with the AFCEE team chief.

2.2.1.5 Lessons Learned - The monitoring well purging procedure was evaluated due to the excessive time spent in purging the wells with bailers. In addition, this procedure created very high turbidities in the ground water which may have an impact on the results for total metals analysis. The laboratory later determined that the nylon bailer line had contributed a semi-volatile contaminant, Caprolactam, which created an interference detected during laboratory analysis. A recommendation was made to AFCEE that conversion to submersible pumps for well purging during the second quarter sampling event would minimize these problems. The AFCEE team chief was in agreement with this recommendation and the change was implemented during the second quarter sampling event.

TABLE 2-2

FIRST QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Ground Water

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
LF01-1A		4-13-95	1045	1	1	0	1
LF01-1C		4-13-95	0935	1	1	0	1
LF01-1D		4-13-95	1130	1	1	0	1
LF01-1E		4-13-95	0945	1	1	0	1
LF04-4A		4-07-95	1600	1	1	0	1
LF04-4B		4-07-95	1540	1	1	0	1
LF04-4D		4-06-95	1632	1	1	0	1
LF04-4E	MS/MSD	4-06-95	1519	1	1	0	1
LF04-4F		4-06-95	1655	1	1	0	1
LF05-5C		4-12-95	1640	1	1	0	1
LF05-5D		4-12-95	1640	1	1	0	1
LF05-5G		4-13-95	1730	1	1	0	1
FT08-11A		4-12-95	1630	1	1	0	1
FT08-11B		4-12-95	1608	1	1	0	1
FT09-12A		4-12-95	1440	1	1	0	1
FT09-12B	MS/MSD	4-12-95	1500	1	1	0	1
FT09-12C		4-12-95	1515	1	1	0	1

280040

TABLE 2-2

FIRST QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Ground Water

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
ST14-01		4-10-95	0915	1	1	0	1
ST14-02		4-10-95	0900	1	1	0	1
ST14-03	Volatiles Not Analyzed	4-13-95	1450	0	1	0	1
ST14-04		4-10-95	1200	1	1	0	1
ST14-W05		4-09-95	1730	1	1	0	1
ST14-W06		4-09-95	1751	1	1	0	1
ST14-W07		4-09-95	1741	1	1	0	1
ST14-W08		4-10-95	1515	1	1	0	1
ST14-W09	MS/MSD	4-09-95	1745	1	1	0	1
ST14-W11		4-10-95	1440	1	1	0	1
ST14-W13		4-10-95	0840	1	1	0	1
ST14-W15		4-10-95	1000	1	1	0	1
ST14-W16		4-11-95	1753	1	1	0	1
ST14-W19	MS/MSD	4-11-95	1555	1	1	0	1
ST14-W20		4-11-95	1455	1	1	0	1
ST14-W21		4-10-95	1145	1	1	0	1
ST14-W22		4-08-95	1510	1	1	0	1
ST14-W23		4-10-95	1015	1	1	0	1
BSSA		4-08-95	1055	1	0	0	0
BSSA		4-13-95	1433	0	1	0	1
BSSB		4-08-95	1000	1	0	0	0
BSSB		4-13-95	1434	0	1	0	1
MW-5		4-08-95	1115	1	0	0	0
MW-5	*	4-13-95	1500	0	1	0	1
MW-7		4-08-95	1030	1	0	0	0
MW-7		4-13-95	1449	0	1	0	1
MW-8		4-07-95	1655	1	1	0	1

* Sample MW-5 collected on 4-13-95 was labeled as GMI22-05.

280041

TABLE 2-2

FIRST QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Ground Water

PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
Method:	SW 8260	SW8270	SW 8080	SW 6010/7000
Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
Preservative 2:	Cool to 4C	None	None	Cool to 4C

SAMPLE ID	COMMENT	SAMPLING INFORMATION LOGDATE	LOGTIME	NUMBER OF SAMPLES PER PARAMETER Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
MW-9		4-07-95	1710	1	1	0	1
MW-10	Not Collected			0	0	0	0
MW-11		4-07-95	1730	1	1	0	1
MW-12		4-07-95	1615	1	1	0	1
GMI04-01M		4-07-95	0800	1	1	0	1
GMI22-01M		4-12-95	1640	1	1	0	1
GMI22-02M		4-12-95	1620	1	1	0	1
GMI22-03M		4-13-95	1215	1	1	0	1
GMI22-04M		4-13-95	1240	1	1	0	1
GMI22-05M		4-13-95	1418	1	1	0	1
GMI22-06M		4-13-95	1155	1	1	0	1
GMI22-07M		4-11-95	1718	1	1	0	1
GMI22-08M	MS/MSD	4-11-95	1700	1	1	0	1
WP07-10B		4-06-95	1715	1	1	0	1
WP07-10C		4-12-95	1715	1	1	0	1
OT15C	MS/MSD	4-08-95	1630	1	1	1	1
SD13-01		4-08-95	1335	1	0	0	0
SD13-01		4-13-95	1615	0	1	0	1
SD13-02		4-08-95	1440	1	1	0	1
SD13-03	MS/MSD	4-08-95	1415	1	0	0	0
SD13-03		4-13-95	1640	0	1	0	1
SD13-05		4-10-95	1130	1	1	0	1
SD13-06		4-08-95	1525	1	1	0	1
SD13-07		4-08-95	1545	1	1	0	1

280042

TABLE 2-2

FIRST QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Ground Water

SAMPLE ID	COMMENT	SAMPLING INFORMATION LOGDATE	LOGTIME	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
				NUMBER OF SAMPLES PER PARAMETER			
P3A		4-11-95	1731	1	1	0	1
T3		4-11-95	1630	1	1	0	1
T4A		4-12-95	1710	1	1	0	1
T7		4-11-95	1753	1	1	0	1
P6A		4-12-95	1735	1	1	0	1
LSA1628-1		6-01-95	1545	1	1	0	1
LSA1628-2		6-01-95	1600	1	1	0	1
LSA1628-3		6-01-95	1645	1	1	0	1
TB-1		4-06-95	1800	1	0	0	0
TB-2		4-07-95	1730	1	0	0	0
TB-3		4-08-95	1800	1	0	0	0
TB-5		4-09-95	1800	1	0	0	0
TB-6		4-10-95	1800	1	0	0	0
TB-5		4-12-95	1800	1	0	0	0
TB-6		4-13-95	1800	1	0	0	0

280043

TABLE 2-2

FIRST QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Ground Water

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
EB-1		4-06-95	1500	1	1	0	1
EB-2		4-07-95	0845	1	1	0	1
EB-3		4-08-95	0810	1	1	0	1
EB-4		4-09-95	1500	1	1	0	1
EB-5		4-10-95	0745	1	1	0	1
EB-6		4-11-95	0740	1	1	0	1
EB-7		4-12-95	0745	1	1	0	1
EB-8		4-13-95	0845	1	1	0	1
EB-99		6-01-95		1	1	0	1
FDUP-1	GMI04-01M	4-07-95	0800	1	1	0	1
FDUP-2	BSSB	4-08-95	1000	1	1	0	1
FDUP-3	ST14-W20	4-11-95	1455	1	1	0	1
FDUP-4	SD13-05	4-10-95	1200	1	1	0	1
FDUP-5	LF01-1E	4-13-95	1200	1	1	0	1
FDUP-6	ST14-W16	4-11-95	1530	1	1	0	1
FDUP-7	FT09-12A	4-12-95	1200	1	1	0	1
FDUP-8	OT15C	4-08-95	1680	1	1	1	1

PREPARED/DATE: JLP 9/25/95
CHECKED/DATE: SDM 09/28/95

280044

2.2.2 Field Program for the Second Quarter Sampling Event

The field program was carried out following procedures consistent with the first quarter sampling activities, with the following exception:

- Well Purging - Due to excess turbidity experienced when purging with dedicated bailers during the first quarterly sampling, the wells were purged using a stainless steel Grundfos pump. Purging was performed until the water quality parameters (pH, specific conductance, and temperature) were stabilized and a minimum of three well bore volumes (WBV) had been removed. Stabilization was defined as: pH within plus or minus 0.1 pH units; specific conductance within 5 percent; and temperature within plus or minus 1 degree Celsius, over consecutive readings. The pH, temperature, specific conductance, and turbidity were measured and recorded at the initiation of purging, after removal of each WBV, and after collection of the samples. Samples were collected using dedicated PVC bailers.

2.2.2.1 Chronology of Field Work - The field activities for the second quarter ground-water sampling event were performed from July 10 through July 17, 1995. Table 2-3 presents the second quarter water level measurements and ground-water elevations. Table 2-4 presents a summary of the sampling activities conducted at each monitoring well during the second quarter sampling event. Copies of the second quarter chain of custody forms are provided in Appendix D and copies of the ground-water sampling reports are provided in Appendix E.

2.2.2.2 Field Quality Assurance/Quality Control - Quality control parameters were consistent with the first quarter quality control program, with the exception of the following:

- Collection of equipment blanks was unnecessary due to the use of dedicated sampling equipment
- Turbidity measurements were recorded as an additional parameter to measure the effectiveness of well purging

2.2.2.3 Lessons Learned - Because of slow ground-water recharge at several wells that were purged dry during the second quarter sampling event, it has been recommended that these wells

TABLE 2-3

SUMMARY OF GROUND-WATER LEVELS AND ELEVATIONS FOR SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

				Quarter 2 (July 1995)	
Monitoring Well	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft. msl)	Ground-Water Level (ft)	Ground-Water Elevation (ft)
LF01-1A	6964379.79	2301262.30	570.27	14.26	556.01
LF01-1C	6964570.37	2301174.14	560	17.69	542.31
LF01-1D	6964260.11	2301399.35	563.93	18.79	545.14
LF01-1E	6964710.02	2301098.23	562.25	17.19	545.06
LF04-4A	6960309.58	2295843.39	625.76	12.56	613.2
LF04-4B	6960344.86	2296285.37	619.9	20.59	599.31
LF04-4D	6960738.32	2296412.03	615.35	19.5	595.85
LF04-4E	6961012.29	2296410.62	618.54	22.82	595.72
LF04-4F	6961077.24	2296017.27	625.36	28.3	597.06
LF05-5C	6961716.52	2295987.93	608.68	10.26	598.42
LF05-5D	6961728.69	2295786.58	611.71	11.71	600
LF05-5G	6961607.55	2296622.04	615.39	20.42	594.97
WP07-10B	6961320.67	2296039.46	624.46	26.66	597.8
WP07-10C	6961551.78	2296048.17	617.24	19.51	597.73
FTO8-11A	6962330.04	2295898.98	608.22	11.57	596.65
FT08-11B	6962046.37	2295940.03	608.14	8.86	599.28
FT09-12A	6960568.13	2295413.09	635.66	17.51	618.15
FT09-12B	6960750.89	2295646.43	627.55	29.41	598.14
FT09-12C	6960642.28	2295709.68	628.05	30.43	597.62
SD13-01	6963365.39	2300590.43	573.24	10.12	563.12
SD13-02	6963471.4	2300634.34	573.39	15.22	558.17
SD13-03	6963353.03	2300673.84	571.54	12.02	559.52
SD13-05	6963890.4	2300754.46	571.4	9.42	561.98
SD13-06	6963183.34	2300951.06	557.66	12.14	545.52
SD13-07	6963200.73	2301022.29	556.3	18.03	538.27
ST14-01	6963286.05	2300092.59	575.89	14.16	561.73
ST14-02	6963520.58	2300063.60	575.64	12.39	563.25
ST14-03	6963830.32	2300017.03	576.6	9.53	567.07
ST14-04	6963661.85	2300334.72	575.74	12.88	562.86
ST14-W05 *	6963734.09	2299085.40	593.75	8.37	585.38
ST14-W06 *	6963806.74	2299323.48	581.33	9.81	571.52
ST14-W07 *	6963600.96	2299371.50	579.98	11.61	568.37
ST14-W08 *	6964290.1	2299504.71	580.43	10.92	569.51
ST14-W09 *	6963444.97	2299531.70	575.51	8.49	567.02
ST14-W11 *	6964102.84	2299619.94	576.21	7.57	568.64
ST14-W13 *	6963827.31	2299719.71	574.35	8.47	565.88
ST14-W15 *	6963292.25	2299899.35	573.35	10.7	562.65

TABLE 2-3

SUMMARY OF GROUND-WATER LEVELS AND ELEVATIONS FOR SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Monitoring Well	Northing (ft)	Easting (ft)	Top of Casing Elevation (ft. msl)	Quarter 2 (July 1995) Ground-Water Level (ft)	Quarter 2 (July 1995) Ground-Water Elevation (ft)
ST14-W16 *	6964189.71	2300093.65	573.46	8.36	565.1
ST14-W19 *	6963724.05	2300183.16	573.11	9.93	563.18
ST14-W20 *	6963983.62	2300288.82	573.44	9.2	564.24
ST14-W21 *	6963323.75	2300221.00	572.76	10.64	562.12
ST14-W22 *	6963743.94	2300972.45	571.16	10.31	560.85
ST14-W23 *	6962939.39	2300316.91	564.97	7.13	557.84
OT15C	6963421.07	2300982.78	567.87	8.66	559.21
P3A	6970359.08	2297661.10	604.77	11.58	593.19
P6A	6960114.88	2295214.14	632.45	11.06	621.39
T3	6968697.5	2300582.55	575.11	4.34	570.77
T4A	6963623.58	2297567.60	606.49	17.82	588.67
T7	6968757.3	2299167.55	604.88	17.91	586.97
MW-5	6965793.95	2300138.54	563.9	5.03	558.87
MW-7	6966018.4	2300064.16	567.88	8.48	559.4
MW-8	6965549.32	2300407.23	556.91	7.2	549.71
MW-9	6965991.2	2300348.98	560.3	8.24	552.06
MW-10	6965908.63	2300460.96	559.53	12.65	546.88
MW-11	6965699.44	2300762.94	558.9	26.35	532.55
MW-12	6966165.08	2300102.06	560.38	7.26	553.12
LSA1628-1	6967935	2297798.40	601.67	9.64	592.03
LSA1628-2	6967957.56	2297868.90	601.93	10.14	591.79
LSA1628-3	6968007.63	2297794.00	601.71	9.55	592.16
BSSA	6965477.12	2300110.37	566.38	5.23	561.15
BSSB	6965775.79	2300068.92	569.73	9.88	559.85
GMI04-01M	6960881.81	2296711.57	NA	18.48	--
GMI22-01M	6965193.71	2297689.70	606.62	17.99	588.63
GMI22-02M	6966618.4	2296162.42	619.19	8.46	610.73
GMI22-03M	6966253.93	2298516.95	607.99	20.34	587.65
GMI22-04M	6967242.46	2297342.02	610.71	19.23	591.48
GMI22-05M	6966966.77	2299409.80	584.36	11.4	572.96
GMI22-06M	6966990.33	2298185.83	606.77	18.05	588.72
GMI22-07M	6969003.09	2298306.26	605.63	15.12	590.51
GMI22-08M	6970349.65	2299013.95	606.92	17.42	589.5

NR = Not recorded
NA = Not available

* Top of casing elevations are based on information provided in September 1995. Other top of casing elevations were submitted in the Basewide Quarterly Ground-Water Monitoring Final Scoping Documents dated March 1995.

PREPARED/DATE: DSS 9/22/95
CHECKED/DATE: JLB 9/25/95

Locations are not surveyed and are considered approximate.

TABLE 2-4

SECOND QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Groundwater

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8240/8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
LF01-1A		7-14-95	1042	1	1	0	1
LF01-1C		7-13-95	1515	1	1	0	1
LF01-1D		7-14-95	0935	1	1	0	1
LF01-1E		7-14-95	1340	1	1	0	1
LF04-4A		7-16-95	1440	1	1	0	1
LF04-4B		7-16-95	1550	1	1	0	1
LF04-4D		7-16-95	1150	1	1	0	1
LF04-4E	MS/MSD	7-16-95	1110	1	1	0	1
LF04-4F		7-16-95	0930	1	1	0	1
LF05-5C		7-13-95	1410	1	1	0	1
LF05-5D		7-13-95	1525	1	1	0	1
LF05-5G		7-12-95	0845	1	1	0	1
FT08-11A		7-14-95	0935	1	1	0	1
FT08-11B		7-14-95	0840	1	1	0	1
FT09-12A		7-13-95	1045	1	1	0	1
FT09-12B	MS/MSD	7-12-95	1540	1	1	0	1
FT09-12C		7-12-95	1115	1	1	0	1

TABLE 2-4

SECOND QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Groundwater

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8240/8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
ST14-01		7-13-95	1025	1	1	0	1
ST14-02		7-13-95	0850	1	1	0	1
ST14-02		7-13-95	1550	1	1		
ST14-04		7-12-95	1405	1	1	0	1
ST14-W05		7-13-95	1125	1	1	0	1
ST14-W06		7-13-95	0940	1	1	0	1
ST14-W07		7-13-95	0840	1	1	0	1
ST14-W08		7-14-95	1153	1	1	0	1
ST14-W09	MS/MSD	7-13-95	1355	1	1	0	1
ST14-W11		7-13-95	1157	1	1	0	1
ST14-W13		7-13-95	1110	1	1	0	1
ST14-W15		7-12-95	1410	1	1	0	1
ST14-W16		7-12-95	1050	1	1	0	1
ST14-W19	MS/MSD	7-13-95	1420	1	1	0	1
ST14-W20		7-12-95	1550	1	1	0	1
ST14-W21		7-12-95	1125	1	1	0	1
ST14-W22		7-14-95	1445	1	1	0	1
ST14-W23		7-12-95	1505	1	1	0	1
BSSA		7-14-95	1550	1	1	0	1
BSSB		7-14-95	1430	1	1	0	1
MW-5		7-15-95	0910	1	1	0	1
MW-7		7-15-95	1015	1	1	0	1
MW-8		7-15-95	1205	1	1	0	1
MW-9		7-15-95	1125	1	1	0	1
MW-10	MS/MSD	7-15-95	1015	1	1	0	1
MW-11		7-15-95	1150	1	1	0	1
MW-12		7-15-95	1455	1	1	0	1

TABLE 2-4

SECOND QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Groundwater

			PARAMETER:	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8240/8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
SAMPLE ID	COMMENT	LOGDATE	LOGTIME				
GMI04-01M		7-16-95	1335	1	1	0	1
GMI22-01M		7-16-95	1045	1	1	0	1
GMI22-02M		7-16-95	0950	1	1	0	1
GMI22-03M		7-16-95	1500	1	1	0	1
GMI22-04M		7-15-95	1640	1	1	0	1
GMI22-05M		7-14-95	1630	1	1	0	1
GMI22-06M		7-15-95	1618	1	1	0	1
GMI22-07M		7-15-95	0840	1	1	0	1
GMI22-08M	MS/MSD	7-15-95	1040	1	1	0	1
WP07-10B		7-12-95	900	1	1	0	1
WP07-10C		7-12-95	915	1	1	0	1
OT15C	MS/MSD	7-16-95	1015	1	1	1	1
SD13-01		7-14-95	0845	1	1	0	1
SD13-02		7-14-95	1100	1	1	0	1
SD13-03	MS/MSD	7-14-95	0905	1	1	0	1
SD13-05		7-16-95	1300	1	1	0	1
SD13-06		7-15-95	1700	1	1	0	1
SD13-07		7-15-95	1550	1	1	0	1
P3A		7-15-95	1525	1	1	0	1
T3		7-14-95	1500	1	1	0	1

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TABLE 2-4

SECOND QUARTER SAMPLING DETAIL
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PROJECT: CARSWELL AFB
NUMBER: 11-3517-3201
Matrix: Groundwater

SAMPLE ID	COMMENT	LOGDATE	LOGTIME	Volatiles	Semi-Volatile Organics	Pesticides	ICP, GFAA and Mercury
			Method:	SW 8240/8260	SW8270	SW 8080	SW 6010/7000
			Container:	40 mL VOA vials	1 L amber glass	1 L amber glass	1 L polyethylene
			Preservative 1:	HCl to pH<2	Cool to 4C	Cool to 4C	HNO_3 to pH<2
			Preservative 2:	Cool to 4C	None	None	Cool to 4C
		SAMPLING INFORMATION		NUMBER OF SAMPLES PER PARAMETER			
T4A		7-14-95	1140	1	1	0	1
T7		7-15-95	1420	1	1	0	1
P6A		7-13-95	1120	1	1	0	1
LSA1628-1		7-16-95	1640	1	1	0	1
LSA1628-2		7-16-95	1735	1	1	0	1
LSA1628-3		7-16-95	1735	1	1	0	1
TB-071295		7-12-95	1700	1	0	0	0
TB-071395		7-13-95	1700	1	0	0	0
TB-071495		7-14-95	1700	1	0	0	0
TB-071795A		7-17-95	1200	1	0	0	0
TB-071795B		7-17-95	1200	1	0	0	0
FDUP-1	GMI04-01M	7-16-95	0730	1	1	0	1
FDUP-2	BSSB	7-14-95	0730	1	1	0	1
FDUP-3	ST14-W20	7-12-95	1600	1	1	0	1
FDUP-4	SD13-05	7-16-95	0730	1	1	0	1
FDUP-5	LF01-1E	7-14-95	1040	1	1	0	1
FDUP-6	ST14-W16	7-12-95	0730	1	1	0	1
FDUP-7	FT09-12A	7-13-95	0730	1	1	0	1
FDUP-8	OT15C	7-16-95	0730	1	1	1	1

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be purged using dedicated bailers in subsequent sampling events. The following wells were affected: ST14-W21, ST14-W23, SD13-02, SD13-06, SD13-07, LF01-1D, LF04-4A, LF04-4B, BSSB, MW-5, MW-7, MW-11, GMI22-05M, and P6A.

2.2.3 Investigation Derived Waste Management

Investigation derived waste (IDW) consisted of purge water from the monitoring wells. The purge water from each sampling event was stored in a 3,000-gallon polyethylene tank until the end of the sampling episode. A sample from the tank was collected and analyzed for volatiles, semi-volatiles, and metals. Based on the analytical results, LAW disposed of the purge water through a ground-water treatment system located on the base.

2.3 LABORATORY ANALYSIS

The following sections describe the analytical program, chronology of laboratory analyses, and the quality assurance/quality control program.

2.3.1 Analytical Program

The Law Environmental, Inc., National Laboratories facility in Pensacola, Florida (LENL-P), a LAW chemical testing laboratory established in 1989, provided sample shipping containers, chain-of-custody documents, chemical analysis, and laboratory quality assurance/quality control (QA/QC).

All ground-water samples were analyzed for volatile organic compounds, semi-volatile organic compounds, and total metals. One monitoring well, OT15C, was also analyzed for pesticides because it is located in the vicinity of an abandoned pesticide disposal well. Ground-water samples were analyzed by the U.S. Environmental Protection Agency (USEPA) SW-846 methodologies listed in Table 2-5. Positive analytical results for the ground-water samples are presented in Appendix F.

TABLE 2-5

ANALYTICAL TEST METHODS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Matrix: Equipment Rinsate/Ground Water

		Holding Time	
Parameter	Method	Extraction	Analysis
Volatile Organics	SW8240/8260	--	14 days
Semi-Volatile Organics	SW3520/8270	7 days	40 days
Total Metals Screen	SW3005/6010	--	6 months
Arsenic	SW3020/7060	--	6 months
Lead	SW3020/7421	--	6 months
Selenium	SW3020/7740	--	6 months
Thallium	SW3020/7841	--	6 months
Mercury	SW7470	--	28 days
Pesticides	SW3520/8080	7 days	40 days

If the volatile organics concentration detected by Method 8260 exceeded the calibration curve, the sample was analyzed and reported by Method 8240.

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Quantitation limits were based on the method detection limits (MDLs) established by the laboratory using the required USEPA procedure specified in 40 CFR Part 136 Appendix B. The 1995 laboratory established detection and quantitation limits are presented in Appendix A of the Final Sampling and Analysis Plan (LAW, 1995a). For methods, SW-8240, SW-8260, and SW-8270, sample results detected below the practical quantitation limit (PQL) but above the MDL were reported and the data were flagged as estimated values using the qualifier "JQ."

Quality control limits are generated annually by the laboratory based on statistical analysis of historic data. The QC limits for laboratory control samples (LCS) recovery, surrogate recovery, and matrix spike/matrix spike duplicate (MS/MSD) recovery and precision were presented in Appendix A of the Final Sampling and Analysis Plan (LAW, 1995a).

2.3.2 Chronology of Laboratory Analyses

The laboratory analyses for the first quarter of ground-water sampling were performed from April 11, 1995, to June 8, 1995. The second quarter of ground-water sampling was analyzed between July 14, 1995, and August 2, 1995. Appendix E provides the date of sampling, extraction/preparation, and analysis for each sample collected during the first and second quarter field events.

2.3.3 Quality Assurance/Quality Control Program

The quality of the chemical data is assessed through the evaluation of both field and laboratory QC data. The QC parameters that were evaluated include: sample preservation and holding time requirements, batch method blank analysis, LCS analysis, internal standard recovery, MS/MSD analysis, surrogate analysis, field duplicate analysis, trip blank analysis, and equipment blank analysis.

2.3.3.1 Sample Handling - Samples were transported to the laboratory daily by overnight express shipment. Upon receipt of the shipment, the laboratory recorded the temperature of each cooler and checked the preservation of samples. Adjustment of sample pH was performed as needed and recorded. Samples were maintained at the laboratory at a temperature of 2 to 8 degrees Celsius until analysis. Holding times for extraction and analysis were strictly adhered to following the requirements of the Sampling and Analysis Plan.

2.3.3.2 Method Blanks - Method blanks consist of organic-free or deionized water that is carried through the analytical scheme like a sample. Positive method blank results indicate the presence of contamination associated with sample preparation or analysis. For most analyses, a method blank is analyzed for each extraction or analysis batch at a frequency of 1 per 20 or fewer samples. If an analyte of interest is detected above the quantitation limit in a method blank, the corrective action consists of reprocessing and reanalyzing the entire sample batch. For the common organic contaminants such as methylene chloride, acetone, toluene, 2-butanone, and phthalates, and the inorganic contaminants, aluminum, calcium, iron, magnesium, sodium and potassium, reanalyses were performed only if contaminants exceeded three times the quantitation limit.

2.3.3.3 Laboratory Control Samples - Laboratory control samples (LCSs) were analyzed with every batch of 20 or fewer samples. LCSs were prepared for each method by the addition of known concentrations of all method analytes. LCSs were carried through the complete sample preparation and analysis procedure, and recoveries of the spiked analytes were determined and compared to QC criteria. Batch acceptance was based on the successful recovery of all analytes of interest as specified in the Sampling and Analysis Plan, and acceptable recovery of at least 80 percent of the total analyte list for each method. Failure to meet these criteria resulted in reprocessing and reanalyzing the entire sample batch.

2.3.3.4 Internal Standards - Internal standard results were evaluated for methods SW-8240/8260 and SW-8270 according to method requirements. Failure to meet the internal standard recovery or retention time criteria resulted in reanalysis of the affected samples.

2.3.3.5 Matrix Spikes - The MS/MSD samples were designated prior to sampling to allow for the collection of additional aliquots of the sample in the field. At the laboratory, the sample aliquots were spiked with known concentrations of the analytes of interest (Table 2-6), and the samples were prepared and analyzed with a batch of 20 or fewer samples. The spike recoveries and the precision between duplicate spikes were calculated and evaluated compared to QC criteria. This technique allows for the assessment of any effect of the matrix on the precision and accuracy of the sample data. MS/MSD samples were collected from eight monitoring wells during the first and second quarter sampling activities. No corrective action was required for MS/MSD recoveries that failed QC criteria as long as the associated LCS results were within control.

2.3.3.6 Surrogates - Surrogates are known amounts of selected compounds added to all field and QC samples prior to preparation and analysis. Surrogate recoveries were evaluated for methods SW-8240/8260, SW-8270, and SW-8080. The recovery of surrogates may be used to determine the effect of the matrix on the accuracy of the sample data. Surrogate recovery failure required reanalysis of the affected sample.

2.3.3.7 Field Precision - Field duplicate samples were collected from eight monitoring well locations during the first and second quarter sampling activities. The results of field duplicates were used to evaluate sampling precision. A relative percent difference (RPD) was calculated from the positive results of the sample and its duplicate, and the RPD values were compared to a precision goal of 30 percent. For sample values less than five times the quantitation limit, the precision is determined by calculating the difference between the concentrations reported in the sample and its duplicate. The criteria used to evaluate this result is the concentration equivalent to two times the PQL. Sample results for those parameters with field precision greater than the criteria of 30 percent RPD or two times the PQL, as applicable, are qualified as estimated values.

2.3.3.8 Trip Blanks - Trip blanks were shipped with each cooler containing samples collected for analysis of volatile compounds. Trip blanks were prepared by the laboratory from organic-

TABLE 2-6

MATRIX SPIKE COMPOUND LIST
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Method SW-8260	1,1-Dichloroethene Trichloroethene Benzene Toluene Chlorobenzene
Method SW-8270	Phenol 2-Chlorophenol 1,4-Dichlorobenzene N-Nitroso-di-n-propylamine 1,2,4-Trichlorobenzene 4-Chloro-3-methylphenol Acenaphthene 4-Nitrophenol 2,4-Dinitrotoluene Pentachlorophenol Pyrene bis(2-Chloroethoxy)methane Butylbenzylphthalate Hexachlorobenzene Benzo(a)pyrene Benzo(a)anthracene Naphthalene
Method SW-8080	gamma-BHC (Lindane) Heptachlor Aldrin Dieldrin Endrin 4,4'-DDT PCB 1016/1260

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free water, and were handled, packaged, preserved, and shipped in a manner similar to actual field samples. Trip blanks were analyzed for volatile organics to detect contamination that may have resulted from cross-contamination or ambient sources of contamination during shipment and handling.

2.3.3.9 Equipment Blanks - Equipment blanks were collected during the first quarter sampling activities to evaluate the effectiveness of equipment decontamination procedures. One equipment blank was collected each day during the first quarter sampling event. Equipment blanks were analyzed for the same parameters as those requested on environmental samples. No equipment blanks were collected during the second quarter sampling activities because dedicated sampling systems were used.

2.3.3.10 Completeness - Completeness measures the amount of usable data resulting from a data collection activity. Completeness for the purpose of this project was defined as the amount of sample data points actually acquired and accepted as valid, divided by the number of sample data points planned to be acquired, expressed as a percentage. Valid data is defined as all data which was not rejected as a result of data quality evaluation. A completeness goal of 90 percent was expected to be achieved for this project.

2.4 DATA EVALUATION

The parameters of precision, accuracy, representativeness, completeness, and comparability are indicators of data quality (USEPA, 1987). The field QC data and laboratory QC data were evaluated to ascertain the quality of the chemical data. The QC data were compared to the criteria presented in the Final Sampling and Analysis Plan (LAW, 1995a). If QC problems were encountered during the performance of sampling and analysis procedures, corrective action was immediately initiated, and the problem and its resolution are reported in the following section. If QC problems affected the data reported for a field sample and corrective action did not resolve the problem, the data for that sample has been qualified. The following sections present the procedures used for evaluation of the field and laboratory data, and the results of the data quality evaluation.

2.4.1 Methodology for Data Quality Assessment

The following sections discuss the evaluation criteria used to review the field and laboratory results, the formulas used to calculate quality control data, and the qualifiers applied to the sample results based on data evaluation.

2.4.1.1 Review of Field Records - Field records were evaluated for the following:

- Completeness of field records
- Identification of valid samples
- Correlation of field testing data
- Identification of anomalous field testing data
- Assessment of accuracy and precision of field testing data
- Completeness of the sampling effort
- Sample preservation, handling, and shipping procedures
- Effectiveness of sampling procedures in preserving sample precision and accuracy

Field records were assessed for completeness and to determine whether field activities were carried out as planned. Samples were evaluated to determine their representativeness through the review of field test results. Anomalous data are discussed in Section 3.1.

2.4.1.2 Review of Laboratory Data - Laboratory data were evaluated for the following:

- Chain of custody forms
- Sample integrity
- Applicability of the instruments/methods used
- Holding times

- Method calibration criteria
- Method blanks
- Verification of quantitation limits
- Laboratory sample preparation records
- Quality control results
- Corrective action for out-of-control QC results
- Calculations used for analyte quantitation and reporting
- Completeness of data

Chemical data evaluation was performed according to LAW's standard operating procedures (SOPs) which were developed following the USEPA "National Functional Guidelines for Organic Data Review" (USEPA, 1990) and "Laboratory Data Validation: Functional Guidelines for Evaluating Inorganic Analyses" (USEPA, 1988). A standard format for the documentation of the results of data evaluation is included in the SOP. This documentation is maintained in the project file at LAW.

2.4.1.3 Formulas - The following formulas were used to calculate quality control data.

Accuracy - Accuracy is defined as the degree of agreement of a measurement with an accepted reference or true value. To determine the accuracy of an analytical method, a sample spiking program was conducted. The results of sample spiking was used to calculate the percent recovery (%R). The percent recovery is defined as follows:

$$\%R = \frac{X - T}{K} \times 100$$

where:

%R = percent recovery
X = analytical result of the spiked sample
T = analytical result of the unspiked sample
K = known amount of the spike in the sample

Surrogates, matrix spike and matrix spike duplicates (MS/MSD), and internal standards were analyzed to determine accuracy. The control limits were based on the mean percent recovery plus or minus 3 standard deviations of the mean using a population of 20 or more recovery values.

Precision - Precision is the measure of mutual agreement among individual measurements of the same property, under similar conditions. Precision between duplicate measurements is best expressed in terms of relative percent difference (RPD). Precision was assessed through the use of field duplicate samples and MS/MSD samples. An RPD for each sample pair was calculated using the following equation:

$$RPD = \frac{A - B}{(A + B)/2} \times 100$$

where:

A = replicate value 1
B = replicate value 2
RPD = relative percent difference

The laboratory established control limits were based on a population of ten or more RPD values. They were calculated by determining the mean RPD plus three times the standard deviation for the upper limit and zero as the lower limit.

Completeness - Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The result is expressed as a percentage determined by analyte, by method.

$$\text{Percent completeness} = \frac{\text{Number of valid measurements}}{\text{Total number of measurements}} \times 100$$

For this project, a completeness goal of 90 percent was established.

2.4.1.4 Data Qualifiers - Data qualifiers are used to flag sample results if accuracy or precision criteria have not met the QC requirements presented in Appendix A in the Final Sampling and Analysis Plan (LAW, 1995a). Data qualification flags used for this project are presented in Table 2-7. Each data point reported is graded as usable as reported, usable with qualifications, or rejected. All data determined to be usable as reported or usable with qualifications are considered valid data for the purpose of calculating the data completeness for the project.

2.4.2 Data Analysis and Interpretation

Monitoring well locations were placed on a base map that was provided to LAW. The locations of the wells presented on each map generated for this report are not surveyed locations and are considered approximate. The location for each well was developed by inserting one surveyed location available and using the relative locations of the other wells to establish a location grid for the entire map. This method was necessary since no comprehensive survey information was available for the base (i.e., wells, buildings, etc.). The well locations generated from this location grid are presented in Table 2-1 and Table 2-3.

The ground-water potentiometric surface contour lines were generated with the Surfer® computer program, Version 4.15, using the Kriging gridding (all search) method for measured water levels. The ground-water levels measured for Quarter 1 and Quarter 2, the top of the casing elevations, and ground-water elevations are listed in Tables 2-1 and 2-3, respectively.

Laboratory reports containing sample results and QC information were reviewed by the laboratory QA coordinator and submitted to LAW. A case narrative was included in each data report to provide an assessment of the laboratory's QA activities. The data presented in the laboratory report was generated from the laboratory's information management system (LIMS) and was reviewed by the LAW project chemist during the data evaluation process. An electronic data deliverable (EDD) was also produced by the laboratory from the LIMS and submitted to LAW. The chemical data tables presented in this report were produced from the EDD files reported by the laboratory. Additional processing of the information contained in the EDD files

TABLE 2-7

DATA QUALIFICATION FLAGS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

FLAG	POSITIVE RESULTS	NEGATIVE RESULTS
FLAGS FOR DATA WITHIN ACCEPTANCE LIMITS (Usable as Reported)		
(no flag)	{Use datum without qualification}	{Use datum without qualification}
FLAGS FOR DATA WITHIN ACTION LIMITS (Usable With Qualification)		
J	Estimated quantitation based upon QC data	Estimated quantitation based upon QC data
JB	Estimated quantitation: possible biased high or false positive based upon blank data	(Not applicable)
JH	Estimated quantitation - possibly biased high based upon QC data	(Not applicable)
JL	Estimated quantitation - possibly biased low based upon QC data	Possible false negative based upon QC data
JQ	Estimated quantitation; result below the PQL	(Not applicable)
FLAGS FOR DATA OUTSIDE OF ACTION LIMITS (Unusable)		
R	Datum rejected based upon QC data: do not use	Datum rejected based upon QC data: do not use
MISCELLANEOUS FLAGS		
t	Tentatively identified compound; identity not confirmed with standard and quantitation estimated (applicable to GC/MS data only)	(Not applicable)

Note that if the QC results suggest contradictory flags, the following hierarchy should be used to select the appropriate flag to assign:

R	> J, JH, JL, JB, JQ
JH + JL	= J
JB	> J
JH or JL	> J

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resulted in the generation of the positive results tables presented in Section 3. Data comparison to the applicable or relevant and appropriate requirements (ARARs) was achieved through visual review of the positive results and the ARARs table. Electronic files of the positive results in ASCII format were created to transfer the data onto computer aided design (CAD) drawings. All data entry results were checked by a reviewer, and approved by the project principal. The following sections present the results of the laboratory data quality evaluation.

2.4.2.1 Laboratory Methods and Detection Limit Requirements - The laboratory followed the analytical methods presented in the Final Sampling and Analysis Plan (LAW, 1995a). All method detection limits provided in Appendix A of the plan were met. Sample results quantitated below the Practical Quantitation Limit (PQL) in order to meet project required detection limits, were qualified as estimated (JQ.)

2.4.2.2 Calibration - Initial calibrations and continuing calibrations were evaluated according to method-specific calibration criteria. All calibrations met the required criteria with the exception of the following:

First Quarter Semi-Volatiles Analyses

- Several continuing calibrations resulted in percent difference values greater than the method criteria. The following compounds were affected: hexachlorocyclopentadiene, benzoic acid, 4-chloroaniline, bis(2-chloroisopropyl)ether, 4-nitrophenol, 2&3-nitroaniline (coeluters), 4-nitroaniline, 3&4-methylphenol (coeluters), 3,3'-dichlorobenzidine, and 2,6-dinitrotoluene. The sample results associated with an analytical batch for which a compound failed the criteria, were qualified as estimated (J).

- The continuing calibration performed on April 14, 1995 resulted in a low relative response factor for 4-nitroaniline. Associated sample results were nondetect; therefore, the sample data for this compound were rejected (R).

Second Quarter Volatiles Analyses

- Method SW-8260 - The relative response factor of the continuing calibration was below the minimum response criterion for 2-chloroethyl vinyl ether for several analysis batches. Associated sample results were nondetect; therefore, the sample data for this compound were rejected (R).

- Method SW-8240 - Several continuing calibrations exhibited high percent differences for 2-chloroethyl vinyl ether. Associated samples were qualified as estimated (J).

Second Quarter Semi-Volatiles Analyses

- The percent relative standard deviation was greater than the method criterion for the initial calibration of 2,4-dinitrophenol. Associated samples were qualified as estimated (J).

- Several continuing calibrations resulted in percent difference values greater than the method criteria for hexachlorocyclopentadiene, benzoic acid, 4-nitrophenol, 4-nitroaniline, bis(2-chloro-isopropyl)ether, 4-chloroaniline, and 3,3'-dichlorobenzene. Associated samples were qualified as estimated (J).

2.4.2.3 Method Blanks - Method blanks were analyzed to determine the effect of laboratory contamination on sample results. Tables 2-8 and 2-9 present the field samples associated with positive method blanks. Method blank results were nondetect with the exception of the following:

First Quarter Metals Analyses

- ICPWB1861 contained 100 μg/L of calcium. Associated positive sample results less than ten times the blank concentration were qualified as estimated (JB).

TABLE 2-8

SUMMARY OF METHOD BLANK RESULTS AND ASSOCIATED SAMPLES
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Analysis Date	Method Blank ID	Analytes Detected	Concentration	Associated Samples
4/11/95	SWB6370	Di-n-butylphthalate	1.3 µg/L	EB-1, LF04-4D, LF04-4E, LF04-4E MS, LF04-43 MSD, LF04-4F, WP07-10B, MW-12, GMI04-01M, LF04-4K, LF04-4B, MW-8, MW-9, FDUP1, MW-11, EB-2
4/14/95	VNB0840	Methylene chloride	5.4 µg/L	LF04-4E, LF04-4D, LF04-4F, WP07-10B, LF04-4E MS, LF04-4E MSD, GMI04-01M, FDUP1
4/18/95	SWB6406	Di-n-butylphthalate	1.2 µg/L	GMI22-05M, LF05-5G, IDW-1, BSSA, BSSB, MW-7, ST14-03, GMI22-05, SD13-01, SD13-03
4/25/95	ICPWB1861	Calcium	100 µg/L	FT09-12B, FT09-12B MS, FT09-12B MSD, FDUP-7, FT09-12A, FT09-12C, EB-7, FT08-11A, LF05-5D, GMI22-02M, GMI22-01M, FT08-11B, LF05-5C, WP07-10C, T4A, P6A
6/5/95	SWB6597	Diethylphthalate	1.4 µg/L	LSA1628-1, LSA1628-2, LSA1628-3, LSA1628-3 MS, LSA1628-3 MSD, EB-99, IDW-1628

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TABLE 2-9

SUMMARY OF METHOD BLANK RESULTS AND ASSOCIATED SAMPLES
SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

Analysis Date	Method Blank ID	Analytes Detected	Concentration	Associated Samples
7/17/95	SWB6813	Di-n-butylphthalate Bis(2-ethylhexyl)phthalate	1.4 µg/L 3.8 µg/L	ST14-W09, ST14-W09 MS, ST14-W09 MSD, LF01-1A, LF05-5C, LF05-5D, FDUP7, FT09-12A, P6A, ST14-03
7/17/95	SWB6814	Di-n-butylphthalate Bis(2-ethylhexyl)phthalate	1.6 µg/L 6.8 µg/L	ST14-219 MSD, ST14-W19, ST14-W19 MS, ST14-01, ST14-W06, ST14-W11, ST14-02, ST14-W05, ST14-W07, ST14-W13
7/24/95	VWB0881	Methylene chloride	2.8 µg/L	WP07-10C, LF05-5G, WP07-10B, LF05-5C, SD13-03, SD13-03 MS, SD13-03 MSD, FDUP2, BSSB, LSA1628-1, LSA1628-2, SD13-07, LF04-4E MSD, LF04-4E MS, LF04-4E

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First Quarter Volatiles Analyses

- VWB0840 contained 5.4 μg/L of methylene chloride. Associated positive sample results less than ten times the blank concentration were qualified as estimated (JB).

First Quarter Semi-Volatiles Analyses

- SWB6370 contained 1.3 μg/L of di-n-butylphthalate. Associated positive sample results less than ten times the blank concentration were qualified as estimated (JB).

Second Quarter Volatiles Analyses

- Method SW-8240 - VWB0881 contained 2.82 μg/L of methylene chloride. No associated samples contained positive results less than ten times the blank concentration; therefore no data were qualified.

Second Quarter Semi-Volatiles Analyses

- SWB6814 contained 6.77 μg/L of bis(2-ethylhexyl)phthalate and 1.56 μg/L of di-n-butylphthalate. Positive results less than ten times the blank concentration were qualified as estimated (JB).

2.4.2.4 Laboratory Control Sample Results - Laboratory control samples (LCSs) were used to demonstrate method accuracy. The LCS analytes which were outside of control limits resulted in the qualification of the associated sample results. The LCS results were within control limits with the exception of the following:

First Quarter Semi-Volatiles Analyses

- SWL6370 had high recovery of benzoic acid. There were no positive results for this analyte; therefore, no data were qualified.

- SWL6396 had no recovery of benzoic acid. Associated positive sample results were qualified "JL," and associated nondetect sample results were rejected and qualified "R."

- SWL6397 had no recovery of benzoic acid. Associated sample results were all nondetect, and were qualified "R," rejected.

Second Quarter Volatiles Analyses

- VWL0882 had high recovery of carbon tetrachloride. There were no positive results for associated samples; therefore, no data were qualified.

- SWL6006 had high recovery of bis(2-chloroisopropyl)ether. There were no positive results for this analyte; therefore, no data were qualified.

Second Quarter Semi-Volatiles Analyses

- SWL8\6813 had high recovery of 4-chloroaniline. There were no positive results for this analyte; therefore, no data were qualified.

- SWL8118 had high recovery of di-n-butylphthalate. Associated positive sample results were qualified "JH."

2.4.2.5 MS/MSD Results - MS/MSD samples were analyzed to assess method accuracy and precision. The results of the analysis of MS/MSD samples are provided in Appendix G. MS/MSD results were within QC ranges with the exception of the following:

First Quarter Metals Analyses

- Sample LF04-4E was analyzed as an MS/MSD sample. Aluminum had low MS and high MSD recoveries. The aluminum RPD was higher than control limits. The associated sample was qualified "J" for aluminum. Iron had low MSD recoveries; however, because the sample concentration was greater than four times the spike amount, the results were not qualified. Arsenic and mercury had low MS and MSD recoveries. The mercury RPD was higher than 20 percent. The associated sample was qualified "JL" for arsenic and mercury.

- Sample SD13-05 was analyzed as an MS/MSD sample. Iron had low MS and MSD recoveries. The associated sample was qualified "JL" for iron. Chromium had low MSD recovery, and the RPD was higher than the control limit. The chromium result was qualified "J."

- Sample ST14-W09 was analyzed as an MS/MSD sample. Aluminum and iron had high MS and low MSD recoveries. The sample concentration for both metals was greater than four times the spike amount; therefore, the sample results were not qualified. Antimony had low MS and MSD recoveries. The sample was qualified "JL" for antimony.

- Sample SD13-03 was analyzed as an MS/MSD sample. The metals data were rejected due to shipping temperatures exceeding acceptable criteria.

- Sample FT09-12B was analyzed as an MS/MSD sample. Iron had high MS and MSD recoveries, and manganese had high MSD recovery. The associated sample was qualified "JH" for iron and manganese.

- Sample GMI22-08M was analyzed as an MS/MSD sample. Aluminum, iron, and manganese had high MS and MSD recoveries, and the RPDs were greater than 20 percent. The sample was qualified "JH" for aluminum and manganese. The sample concentration for iron was greater than four times the spike amount; therefore, the results were not qualified for iron. Lead had low MSD recovery, and the RPD was greater than 20 percent. Due to the RPD exceedance, the sample was qualified "J" for lead.

- Sample ST14-W19 was analyzed as an MS/MSD sample. Aluminum, iron, and lead had low MS and MSD recoveries. The associated sample was qualified "J" for lead. Since the MSD recovery and RPD were within QC limits for aluminum and iron, results for these two parameters were not qualified. Manganese had low MSD recovery, and the RPD was greater than 20 percent. Due to the RPD exceedance, the sample was qualified "J" for manganese.

First Quarter Pesticide/PCB Analyses

- Sample OT15C was analyzed as an MS/MSD sample. 4,4'-DDT had low MS and MSD recoveries. The associated sample was qualified "JL" for 4,4'-DDT.

First Quarter Volatiles Analyses

- Method SW-8260 - Samples SD13-05 and ST14-W09 were analyzed as MS/MSD samples. 1,1-dichloroethene had high MS and MSD recoveries. The sample results for 1,1-dichloroethene were nondetect; therefore, the sample data were not qualified.

- Sample OT15C was analyzed as an MS/MSD sample. Tetrachloroethene had high MS and MSD recoveries. The associated sample was qualified "JH" for tetrachloroethene.

First Quarter Semi-Volatiles Analyses

- Sample LF04-4E was analyzed as an MS/MSD sample. Benzo(a)pyrene had an RPD greater than QC limits. The associated sample was qualified "J" for benzo(a)pyrene.

- Sample SD13-03 was analyzed as an MS/MSD sample. 4-nitrophenol had high MS and MSD recoveries. The semi-volatile data were rejected due to shipping temperatures exceeding acceptable criteria.

- Sample GMI22-08M was analyzed as an MS/MSD sample. 4-nitrophenol had high MS and MSD recoveries, and benzo(a)pyrene had an RPD greater than QC limits. The associated sample result for 4-nitrophenol was nondetect; therefore, the data were not qualified. The sample result for benzo(a)pyrene was qualified "J."

- Sample ST14-W19 was analyzed as an MS/MSD sample. 4-nitrophenol had high MS and MSD recoveries. The sample result was nondetect for 4-nitrophenol; therefore, the data were not qualified.

- Sample FT09-12B was analyzed as an MS/MSD sample. 4-nitrophenol had high MS and MSD recoveries, and the RPD result was greater than the control limits. The associated sample result for 4-nitrophenol was qualified "J."

Second Quarter Metals Analyses

- Sample ST14-W19 was analyzed as an MS/MSD sample. Iron had low MS and high MSD recoveries. The RPD was outside control limits. The associated sample concentration was greater than four times the spike amount; therefore, the results were not qualified. Arsenic had low MS and MSD recoveries. The sample was qualified "JL" for arsenic.

- Sample SD13-03 was analyzed as an MS/MSD sample. Iron had low MS and MSD recoveries. Because the sample concentration was greater than four times the spike amount, the results were not qualified.

- Sample OT15C was analyzed as an MS/MSD sample. Aluminum had high RPD. The sample was qualified "J."

- Sample GMI22-08M was analyzed as an MS/MSD sample. Aluminum and iron had high MS and MSD recoveries. The sample concentrations for both metals were greater than four times the spike amount; therefore, the results were not qualified. Arsenic had low MS and MSD recoveries. The sample was qualified "JL" for arsenic.

- Sample MW-10 was analyzed as an MS/MSD sample. Manganese had low MS recovery. The sample concentration was greater than four times the spike amount; therefore, no data were qualified.

Second Quarter Volatiles Analyses

- Method SW-8260 - Sample FT09-12B was analyzed as an MS/MSD sample. Trichloroethene had high MS and MSD recoveries. Tetrachloroethene had high MSD recovery. The sample was qualified "JH" for both compounds.

- Sample ST14-W19 was analyzed as an MS/MSD sample. Benzene had high MS and MSD recoveries. The sample was qualified "JH."

- Sample GMI22-08M was analyzed as an MS/MSD sample. 1,1-dichloroethene had high MSD recovery. The sample result was nondetect for 1,1-dichloroethene; therefore, no data were qualified.

Second Quarter Semi-Volatiles Analyses

- Sample SD13-03 was analyzed as an MS/MSD sample. 4-nitrophenol had high MS and MSD recoveries. The sample result was nondetect for 4-nitrophenol, and the data were not qualified.

- Sample MW-10 was analyzed as an MS/MSD sample. Naphthalene had low MS and MSD recoveries. Because the sample concentration was greater than four times the spike amount, the results were not qualified.

2.4.2.6 Holding Times and Preservation - The holding times were met for all parameters for both first and second quarter samples. Appendix H presents the dates of sampling, preparation/extraction, and analysis for each sample collected during the first and second quarter sampling events. The preservation requirement for sample pH was exceeded for some metals samples collected during the first quarter sampling event. The associated data were qualified "J," estimated quantitation.

2.4.2.7 Surrogate and Internal Standard Analysis Results - Internal and surrogate standard recoveries were used to indicate acceptable extraction and analytical performance for each sample. Corrective actions initiated included re-extraction/reanalysis of samples exhibiting poor surrogate recovery and internal standard failures, unless failure was due to dilution. All surrogate and internal standards were within control limits with the exception of the following:

First Quarter Semi-Volatiles Analyses

- Samples LF04-4D, LF04-4D-Reanalysis, MW-8, MW-8-Reanalysis, FT08-11B, FT08-11B-Reanalysis, LF05-5C, LF05-5C-Reanalysis, ST14-03, and ST14-03-Reanalysis, had low recoveries for the internal standard, perylene-d12. The analytes associated with this internal standard were qualified "J" for these samples.

- Sample LF04-4E had low semi-volatile surrogate recovery for phenol-d6. All acid extractable compounds for sample LF04-4E were qualified "JL."

Second Quarter Semi-Volatiles Analyses

- All surrogate recoveries were outside of control limits for samples LSA1628-1 and LSA1628-2, due to a required 50x dilution; therefore, no results were qualified.

2.4.2.8 Field Duplicates - Field duplicate samples were analyzed to assess sampling precision for the analytes detected. The results of the field duplicate analyses and the corresponding RPDs are presented in Tables 2-10 and 2-11. The RPDs calculated were less than 30 percent with the exception of the following:

First Quarter Metals Analyses

- Sample GMI04-01M and its duplicate FDUP-1 had an RPD greater than 30 percent for nickel and zinc. Both samples were qualified "J" for nickel and zinc.
- Sample SD13-05 and its duplicate FDUP-4 had an RPD greater than 30 percent for zinc. Both samples were qualified "J" for zinc.
- Sample OT15C and its duplicate FDUP-8 had an RPD greater than 30 percent for manganese. Both samples were qualified "J" for manganese.
- Sample FT09-12A and its duplicate FDUP-7 had an RPD greater than 30 percent for aluminum and iron. Both samples were qualified "J" for aluminum and iron.
- Sample ST14-20 and its duplicate FDUP-3 had an RPD greater than 30 percent for aluminum. Both samples were qualified "J" for aluminum.
- Sample LF01-1E and its duplicate FDUP-5 had an RPD greater than 30 percent for iron. Both samples were qualified "J" for iron.
- Sample FT09-12A and its duplicate FDUP-7 had an RPD greater than 30 percent for zinc. The samples were not qualified because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

TABLE 2-10

DUPLICATE SUMMARY TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	FDUP-1	GMI04-01M	% RPD	FDUP-4	SD13-05	% RPD	FDUP-2	BSSB	% RPD
Sample Date:	07-APR-95	07-APR-95		10-APR-95	10-APR-95		08-APR-95	08-APR-95	
Notes:	Duplicate of GMI04-01M			Duplicate SD13-05			Duplicate of BSSB		
METALS, TOTAL BY ICP/SW 6010 (µg/L)									
Aluminum	1100	1000	9.5	570	770	29.9			
Barium	97	110	12.6	200	210	4.9			
Calcium	180000	180000	0.0	150000	150000	0.0			
Iron	2100	2200	4.7	1000	1300 JL	26.1			
Magnesium	9000	9100	1.1	4600	4700	2.2			
Manganese	180	180	0.0	81	83	2.4			
Nickel	<50 J	160 J	104.8						
Potassium	5100	5100	0.0	1800	1900	5.4			
Sodium	31000	31000	0.0	32000	33000	3.1			
Vanadium									
Zinc	74 J	<10 J	152.4	50 J	74 J	38.7			
ARSENIC, TOTAL BY GFAA/SW 7060 (µg/L)									
Arsenic									
LEAD, TOTAL BY GFAA/SW3005M/7421 (µg/L)									
Lead									
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8240/NONE (µg/L)									
Benzene							3400 J	80 J	190.8
Ethylbenzene							2000	1700	16.2
Methylene chloride	160	150	6.5						
Toluene							21000	20000	4.9
Trichloroethene	1200	1300	8.0						
Xylenes (total)							11000	9300	16.7
cis-1,2-Dichloroethene	510	520	1.9						
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)									
Methylene chloride									
Tetrachloroethene									
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)									
Naphthalene									

* NOTE: Percent RPD values greater than 30% are shown in boxes unless the sample or its duplicate is less than five times the PQL and the difference between the concentrations is less than two times the PQL. Samples were qualified as estimated, "J," if the %RPD value exceeded this criterion.

Results in boxes are reported above PQL

TABLE 2-10

DUPLICATE SUMMARY TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Sample ID: FDUP-8 Sample Date: 08-APR-95 Notes: Duplicate of OT15C	OT15C 08-APR-95	% RPD	FDUP-6 11-APR-95 Duplicate of ST14-W16	ST14-W16 11-APR-95	% RPD	FDUP-3 11-APR-95 Duplicate of ST14-W20	ST14-W20 11-APR-95	% RPD
METALS, TOTAL BY ICP/SW 6010 (µg/L)									
Aluminum	3200	4100	24.7	50000%	670	29.1	17000 J	12000 J	34.5
Barium	170	190	11.1	13000%	130	0.0	280	280	0.0
Calcium	170000	180000	5.7	14000000%	140000	0.0	380000	360000	5.4
Iron	2600	3300	23.7	1200000%	12000	0.0	42000	38000	10.0
Magnesium	5100	5300	3.8	670000%	6800	1.5	9700	9000	7.5
Manganese	220 J	330 J	40.0	33000%	310	6.3	650	640	1.6
Nickel									
Potassium	2700	2700	0.0	190000%	2300	19.0	4400	3300	28.6
Sodium	25000	25000	0.0	2500000%	26000	3.9	20000	20000	0.0
Vanadium							68	56	19.4
Zinc	<10	12	18.0	<10	11	9.5	97	86	12.0
ARSENIC, TOTAL BY GFAA/SW 7060 (µg/L)									
Arsenic				2900%	22	27.5	18	18	0.0
LEAD, TOTAL BY GFAA/SW3005M/7421 (µg/L)									
Lead				950%	8.8	0.1			
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8240/NONE (µg/L)									
Benzene				7800%	91	15.4	90	98	8.5
Ethylbenzene									
Methylene chloride				1300% JB	11 JB	16.7	8.3	13	44.1
Toluene									
Trichloroethene									
Xylenes (total)									
cis-1,2-Dichloroethene									
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)									
Methylene chloride									
Tetrachloroethene	2.3 JH	2.4 JH	4.3						
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)									
Naphthalene				1100%	9.8	11.5			

* NOTE: Percent RPD values greater than 30% are shown in boxes unless the sample or its duplicate is less than five times the PQL and the difference between the concentrations is less than two times the PQL. Samples were qualified as estimated, "J,", if the %RPD value exceeded this criterion.

Results in boxes are reported above PQL

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TABLE 2-10

DUPLICATE SUMMARY TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Sample ID: / Sample Date: / Notes:	FDUP-7 12-APR-95 Duplicate of FT09-12A		FT09-12A 12-APR-95		% RPD	FDUP-5 13-APR-95 Duplicate of LF01-1E		LF01-1E 13-APR-95		% RPD
METALS, TOTAL BY ICP/SW 6010 (µg/L)											
Aluminum		2200	J	3000	J	$\boxed{30.8}$	<500		650	JB	26.0
Barium		110		120		8.7	130		110		16.7
Calcium		120000		140000		15.4	140000		120000		15.4
Iron		2000	J	3500	J	$\boxed{54.5}$	280	J	500	J	$\boxed{56.4}$
Magnesium		4100		4400		7.1	8400		7200		15.4
Manganese		68		86		23.4	3200		3100		3.2
Nickel											
Potassium		1200		1400		15.4					
Sodium		15000		15000		0.0	21000		18000		15.4
Vanadium											
Zinc		<10		14		33.0	10		<10		0.0
ARSENIC, TOTAL BY GFAA/SW 7060 (µg/L)											
Arsenic											
LEAD, TOTAL BY GFAA/SW3005M/7421 (µg/L)											
Lead											
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8240/NONE (µg/L)											
Benzene											
Ethylbenzene											
Methylene chloride											
Toluene											
Trichloroethene											
Xylenes (total)											
cis-1,2-Dichloroethene											
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)											
Methylene chloride		1.9	JB	2.2	JB	14.6					
Tetrachloroethene											
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)											
Naphthalene											

* NOTE: Percent RPD values greater than 30% are shown in boxes unless the sample or its duplicate is less than five times the PQL and the difference between the concentrations is less than two times the PQL. Samples were qualified as estimated, "J,", if the %RPD value exceeded this criterion.

☐ Results in boxes are reported above PQL

PREPARED/DATE: JLP 9/25/95
CHECKED/DATE: SDM 10/2/95

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TABLE 2-11

DUPLICATE SUMMARY TABLE
SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD (units)	Sample ID: / Sample Date: / Notes:	FDUP-2 14-Jul-95 Duplicate BSSB	BSSB 14-Jul-95	% RPD	FDUP-7 13-Jul-95 Duplicate of FT09-12A	FT09-12A 13-Jul-95	% RPD	FDUP-1 16-Jul-95 Duplicate of GMI04-01M	GMI04-01M 16-Jul-95	% RPD	FDUP-5 14-Jul-95 Duplicate of LF01-1E	LF01-1E 14-Jul-95	% RPD
METALS, TOTAL by ICP/SW 6010 (µg/L)													
Aluminum		867 J	616 J	$\boxed{33.9}$	5400	4660	14.7				2140	1600	28.9
Barium		131	146	10.8	121	131	7.9	96	96	0.0	388	295	27.2
Calcium		158000	155000	1.9	153000	148000	3.3	149000	150000	0.7	107000	114000	6.3
Iron		18900	16600	13.0	5530	4760	15.0	51	54	5.7	2740	2140	24.6
Magnesium		12700	12700	0.0	4850	4680	3.6	8320	8360	0.5	8600	8150	5.4
Manganese		621	606	2.4	141	135	4.3	121	121	0.0	10100 J	7340 J	$\boxed{31.7}$
Potassium		1030	924	10.8	1910	1760	8.2	3610	3630	0.6	707	<600	16.4
Sodium		67100	67500	0.6	15100	15000	0.7	27200	27300	0.4	16200	16600	2.4
Zinc											10	<10.0	0.0
ARSENIC, TOTAL by GFAA/SW 7060 (µg/L)													
Arsenic		54.7 J	40.3 J	$\boxed{30.3}$									
LEAD, TOTAL by GRAA/SW 3005M/7421 (µg/L)													
Lead		6.19	<5.00	21.3									
Volatile Organic Compounds by GC/MS - SW8240/NONE (µg/l)													
Benzene		1600	1720	7.2									
Ethylbenzene		1120	1170	4.4									
Methylene chloride		1000	<1000	0.0				58.2 J	40.4 J	$\boxed{36.1}$			
Toluene		8080	8990	10.7									
Trichloroethene								948	998	5.1			
Xylenes (total)		5170	5530	6.7									
cis-1,2-Dichloroethene								326	339	3.9			
Volatile Organic Compounds by GC/MS - SW8260/NONE (µg/L)													
Benzene													
Ethylbenzene													
Methylene chloride													
Tetrachloroethene													
Toluene													
Trichloroethene													
Xylenes (total)													
cis-1,2-Dichloroethene													
Semi-Volatile Organic Compounds by GC/MS - SW8270/SW3520 (µg/L)													
2-Methylnaphthalene		187	192	2.6									
Butyl benzyl phthalate					14.5	7.52 JQ	63.4	36.1	31.8	12.7			
Naphthalene		583	583	0.0									
Phenol													

* NOTE: Percent RPD values greater than 30% are shown in boxes unless the sample or its duplicate is less than five times the PQL and the difference between the concentrations is less than two times the PQL. Samples were qualified as estimated, "J," if the %RPD value exceeded this criterion.

☐ Results in boxes are reported above PQL

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TABLE 2-11

DUPLICATE SUMMARY TABLE
SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD (units)	Sample ID: FDUP-8 Sample Date: 16-Jul-95 Notes: Duplicate of OT15C	OT15C 16-Jul-95	% RPD	FDUP-4 16-Jul-95 Duplicate of SD13-05	SD13-05 16-Jul-95	% RPD	FDUP-6 12-Jul-95 Duplicate of ST14-W16	ST14-W16 12-Jul-95	% RPD	FDUP-3 12-Jul-95 Duplicate of ST14-W20	ST14-W20 12-Jul-95	% RPD
METALS, TOTAL by ICP/SW 6010 (µg/L)												
Aluminum							2230 J	3870 J	$\boxed{53.8}$	9510	9750	2.5
Barium	168	167	0.6	230	208	10.0	144	154	6.7	251	259	3.1
Calcium	132000	131000	0.8	140000	139000	0.7	165000	193000	15.6	257000	298000	14.8
Iron							26300	33600	24.4	30000	31100	3.6
Magnesium	4150	4150	0.0	4590	4560	0.7	7040	7490	6.2	8340	8560	2.6
Manganese	222	223	0.4	106	105	0.9	503	595	16.8	568	609	7.0
Potassium	2530	2530	0.0	2140	2090	2.4	1930	2250	15.3	2800	2900	3.5
Sodium	27100	27200	0.4	31300	30700	1.9	24500	24400	0.4	21200	20700	2.4
Zinc							24 J	42 J	$\boxed{54.5}$	73	83	12.8
ARSENIC, TOTAL by GFAA/SW 7060 (µg/L)												
Arsenic							36.1	31.8	12.7	48.7	47.5	2.5
LEAD, TOTAL by GRAA/SW 3005M/7421 (µg/L)												
Lead							32.6 J	48.3 J	$\boxed{38.8}$	23.6	26	9.7
Volatile Organic Compounds by GC/MS - SW8240/NONE (µg/l)												
Benzene												
Ethylbenzene												
Methylene chloride												
Toluene												
Trichloroethene												
Xylenes (total)												
cis-1,2-Dichloroethene												
Volatile Organic Compounds by GC/MS - SW8260/NONE (µg/L)												
Benzene	0.625	0.777	21.7				191	180	5.9	3.15 J	12.6 J	$\boxed{120.0}$
Ethylbenzene	0.539	0.673	22.1				3.1	2.67	14.9			
Methylene chloride										<2.00	4.3 JB	73
Tetrachloroethene	0.668	0.747	11.2									
Toluene	5.11	6.44	23.0									
Trichloroethene	1.53 J	3.64 J	$\boxed{81.6}$									
Xylenes (total)	2.69	3.61	29.2									
cis-1,2-Dichloroethene	<0.500	0.925	59.6									
Semi-Volatile Organic Compounds by GC/MS - SW8270/SW3520 (µg/L)												
2-Methylnaphthalene							18.2	9.04 JQ	67.3			
Butyl benzyl phthalate	53	53.3	0.6									
Naphthalene							45.1 J	22.8 J	$\boxed{65.7}$			
Phenol							15.3	10.1 JQ	40.9			

* NOTE: Percent RPD values greater than 30% are shown in boxes unless the sample or its duplicate is less than five times the PQL and the difference between the concentrations is less than two times the PQL. Samples were qualified as estimated, "J," if the %RPD value exceeded this criterion.

☐ Results in boxes are reported above PQL

PREPARED/DATE: JLP 10/25/95
CHECKED/DATE: SDM 10/2/95

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First Quarter Volatiles Analyses

- Method SW-8240 - Sample BSSB and its duplicate FDUP-2 had an RPD greater than 30 percent for benzene. Both samples were qualified "J" for benzene.

- Sample ST14-W20 and its duplicate FDUP-3 had an RPD greater than 30 percent for methylene chloride. The samples were not qualified because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

Second Quarter Metals Analyses

- Sample ST14-W16 and its duplicate FDUP-6 had an RPD greater than 30 percent for aluminum, zinc, and lead. Both samples were qualified "J" for aluminum, zinc, and lead.

- Sample LF01-1E and its duplicate FDUP-5 had an RPD greater than QC limits for manganese. Both samples were qualified "J" for manganese.

- Sample BSSB and its duplicate FDUP-2 had an RPD greater than 30 percent for aluminum and arsenic. Both samples were qualified "J" for aluminum and arsenic.

Second Quarter Volatiles Analyses

- Method SW-8260 - Sample ST14-W20 and its duplicate FDUP-3 had an RPD greater than QC limits for benzene. Both samples were qualified "J" for benzene.

- Sample GMI04-01M and its duplicate FDUP-1 had an RPD greater than 30 percent for methylene chloride. Both samples were qualified "J" for methylene chloride.

- Sample OT15C and its duplicate FDUP-8 had an RPD greater than QC limits for trichloroethene and cis-1,2-dichloroethene. Both samples were qualified "J" for trichloroethene. The samples were not qualified for cis-1,2-dichloroethene because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

- Sample ST14-W20 and its duplicate FDUP-3 had an RPD greater than 30 percent for methylene chloride. The samples were not qualified because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

Second Quarter Semi-Volatiles Analyses

- Sample ST14-W16 and its duplicate FDUP-6 had an RPD greater than 30 percent for naphthalene, 2-methylnaphthalene, and phenol. Both samples were qualified "J" for naphthalene. The samples were not qualified for 2-methylnaphthalene and phenol because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

- Sample FT09-12A and its duplicate FDUP-7 had an RPD greater than 30 percent for butyl benzyl phthalate. The samples were not qualified because the results were less than five times the PQL, and the difference between the sample and its duplicate was less than two times the PQL, indicating acceptable precision at low concentrations.

2.4.2.9 Field Blanks - Trip blanks were analyzed to assess sample contamination that may have occurred during shipping, and equipment blanks were analyzed to assess sample contamination that may have occurred during sample collection. Table 2-12 presents the results of equipment blanks, and Table 2-13 presents the results of trip blanks. Field blank results were nondetect with the exception of the following:

First Quarter Metals Analyses - Equipment Blanks

- Equipment blanks, EB-3, EB-4, EB-5, EB-6, EB-7, and EB-99 contained calcium at concentrations ranging from 150 μg/L to 370 μg/L. All associated sample results for calcium were greater than five times the blank concentration; therefore, no results were qualified.

TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-1 06-APR-95	EB-2 07-APR-95	EB-3 08-APR-95	EB-4 09-APR-95	EB-5 10-APR-95
METALS, TOTAL BY ICP/SW 6010 (µg/L)							
Aluminum	500		<500	<500	<500	<500	<500
Antimony	250		<250	<250	<250	<250	<250
Barium	20.0		<20	<20	<20	<20	<20
Beryllium	3.00		<3.0	<3.0	<3.0	<3.0	<3.0
Cadmium	10.0		<10	<10	<10	<10	<10
Calcium	100		<100	<100	150	260	360
Chromium	50.0		<50	<50	<50	<50	<50
Cobalt	50.0		<50	<50	<50	<50	<50
Copper	50.0		<50	<50	<50	<50	<50
Iron	50.0		<50	<50	<50	<50	<50
Magnesium	250		<250	<250	<250	<250	<250
Manganese	10.0		<10	<10	<10	<10	<10
Molybdenum	50.0		<50	<50	<50	<50	<50
Nickel	50.0		<50	<50	<50	<50	<50
Potassium	600		<600	<600	<600	<600	<600
Silver	50.0		<50	<50	<50	<50	<50
Sodium	250		<250	<250	<250	<250	<250
Vanadium	50.0		<50	<50	<50	<50	<50
Zinc	10.0		<10	<10	<10	<10	<10
ARSENIC, TOTAL BY GFAA/SW 7060 (µg/L)							
Arsenic	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
LEAD, TOTAL BY GFAA/SW3005M/7421 (µg/L)							
Lead	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
MERCURY, TOTAL BY CVAA/SW 7470 (µg/L)							
Mercury	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
SELENIUM, TOTAL BY GFAA - SW7740/METHOD (µg/L)							
Selenium	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
THALLIUM, TOTAL BY GFAA/SW3020/7841 (µg/L)							
Thallium	2.00		<2.0	<2.0	<2.0	<2.0	<2.0
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)							
1,1,1-Trichloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	1.00		<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	1.00		<1.0	<1.0	<1.0	<1.0	<1.0

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : Sample Date : Notes:	EB-1 06-APR-95	EB-2 07-APR-95	EB-3 08-APR-95	EB-4 09-APR-95	EB-5 10-APR-95
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)(Cont'd)							
1,2-Dichloropropane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
2-Butanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloroethyl vinyl ether	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Bromodichloromethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	1.00		<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0
Carbon disulfide	1.00		<1.0	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Chlorobenzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Chloroethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform	0.500		0.54	<0.50	0.60	0.78	<0.50
Chloromethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Methylene chloride	2.00		1.2 JB	2.5	2.4 JB	2.1 JB	1.7 JB
Styrene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Toluene	0.500		<0.50	2.2	<0.50	<0.50	0.83
Trichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
Vinyl acetate	5.00		<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl chloride	2.00		<2.0	<2.0	<2.0	<2.0	<2.0
Xylenes (total)	1.00		<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50
% Surrogate Recovery (Control Limit)							
sur-1,2-Dichloroethane-d4 %R 76-114 R% (76 - 114)			95	95	94	96	92
sur-Bromofluorobenzene %R 86-115 R% (86 - 115)			95	96	95	95	91
sur-Toluene-d8 %R 88-110 R% (88 - 110)			100	101	99	99	99
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)							
1,2,4-Trichlorobenzene	10.0		<13	<11	<11	<12	<12
1,2-Dichlorobenzene	10.0		<13	<11	<11	<12	<12
1,3-Dichlorobenzene	10.0		<13	<11	<11	<12	<12
1,4-Dichlorobenzene	10.0		<13	<11	<11	<12	<12
2,4,5-Trichlorophenol	20.0		<26	<22	<21	<23	<24

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : Sample Date : Notes:	EB-1 06-APR-95	EB-2 07-APR-95	EB-3 08-APR-95	EB-4 09-APR-95	EB-5 10-APR-95
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)(Cont'd)							
2,4,6-Trichlorophenol	10.0		<13	<11	<11	<12	<12
2,4-Dichlorophenol	10.0		<13	<11	<11	<12	<12
2,4-Dimethylphenol	10.0		<13	<11	<11	<12	<12
2,4-Dinitrophenol	50.0		<64	<54	<53	<58	<60
2,4-Dinitrotoluene	10.0		<13	<11	<11	<12	<12
2,6-Dinitrotoluene	10.0		<13	<11	<11	<12	<12
2-Chloronaphthalene	10.0		<13	<11	<11	<12	<12
2-Chlorophenol	10.0		<13	<11	<11	<12	<12
2-Methylnaphthalene	10.0		<13	<11	<11	<12	<12
2-Methylphenol	10.0		<13	<11	<11	<12	<12
2-Nitroaniline	50.0		<64	<54 J	<53 J	<58	<60
2-Nitrophenol	10.0		<13	<11	<11	<12	<12
3,3'-Dichlorobenzidine	20.0		<26	<22	<21	<23	<24
3-Nitroaniline	50.0		<64	<54 J	<53 J	<58	<60
4,6-Dinitro-2-methylphenol	50.0		<64	<54	<53	<58	<60
4-Bromophenyl phenyl ether	10.0		<13	<11	<11	<12	<12
4-Chloro-3-methylphenol	10.0		<13	<11	<11	<12	<12
4-Chloroaniline	20.0		<26	<22	<21	<23	<24
4-Chlorophenyl phenyl ether	10.0		<13	<11	<11	<12	<12
4-Methylphenol	10.0		<13	<11	<11	<12	<12
4-Nitroaniline	50.0		<64	<54	<53 J	<58	<60
4-Nitrophenol	50.0		<64	<54	<53	<58	<60
Acenaphthene	10.0		<13	<11	<11	<12	<12
Acenaphthylene	10.0		<13	<11	<11	<12	<12
Anthracene	10.0		<13	<11	<11	<12	<12
Benz(a)anthracene	10.0		<13	<11	<11	<12	<12
Benzo(a)pyrene	10.0		<13	<11	<11	<12	<12
Benzo(b)fluoranthene	10.0		<13	<11	<11	<12	<12
Benzo(g,h,i)perylene	10.0		<13	<11	<11	<12	<12
Benzo(k)fluoranthene	10.0		<13	<11	<11	<12	<12
Benzoic acid	50.0		<64	<54	<53	<58 J	<60 J
Benzyl alcohol	20.0		<26	<22	<21	<23	<24
Butyl benzyl phthalate	10.0		<13	<11	<11	<12	<12
Chrysene	10.0		<13	<11	<11	<12	<12
Di-n-butylphthalate	10.0		$\boxed{1.2\ JB}$	$\boxed{1.0\ JB}$	<11	<12	<12
Di-n-octylphthalate	10.0		<13	<11	<11	<12	<12
Dibenz(a,h)anthracene	10.0		<13	<11	<11	<12	<12
Dibenzofuran	10.0		<13	<11	<11	<12	<12
Diethylphthalate	10.0		<13	<11	<11	<12	<12
Dimethylphthalate	10.0		<13	<11	<11	<12	<12
Fluoranthene	10.0		<13	<11	<11	<12	<12
Fluorene	10.0		<13	<11	<11	<12	<12

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-1 06-APR-95	EB-2 07-APR-95	EB-3 08-APR-95	EB-4 09-APR-95	EB-5 10-APR-95
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)(Cont'd)							
Hexachlorobenzene	10.0		<13	<11	<11	<12	<12
Hexachlorobutadiene	10.0		<13	<11	<11	<12	<12
Hexachlorocyclopentadiene	10.0		<13	<11	<11	<12 J	<12 J
Hexachloroethane	10.0		<13	<11	<11	<12	<12
Indeno(1,2,3-cd)pyrene	10.0		<13	<11	<11	<12	<12
Isophorone	10.0		<13	<11	<11	<12	<12
Naphthalene	10.0		<13	<11	<11	<12	<12
Nitrobenzene	10.0		<13	<11	<11	<12	<12
Pentachlorophenol	30.0		<38	<32	<32	<35	<36
Phenanthrene	10.0		<13	<11	<11	<12	<12
Phenol	10.0		<13	<11	<11	<12	<12
Pyrene	10.0		<13	<11	<11	<12	<12
bis(2-Chloroethoxy)methane	10.0		<13	<11	<11	<12	<12
bis(2-Chloroethyl)ether	10.0		<13	<11	<11	<12	<12
bis(2-Chloroisopropyl)ether	10.0		<13	<11	<11	<12	<12
bis(2-Ethylhexyl)phthalate	10.0		<13	<11	<11	<12	<12
n-Nitrosodinpropylamine	10.0		<13	<11	<11	<12	<12
n-Nitrosodiphenylamine	10.0		<13	<11	<11	<12	<12
% Surrogate Recovery (Control Limit)							
sur-2,4,6-Tribromophenol %R 10-123 R% (10 - 123)			62	74	78	61	63
sur-2-Fluorobiphenyl %R 43-116 R% (43 - 116)			57	66	68	51	54
sur-2-Fluorophenol %R 21-100 R% (21 - 100)			55	75	79	51	53
sur-Nitrobenzene-d5 %R 35-114 R% (35 - 114)			52	63	68	56	55
sur-Phenol-d6 %R 10-94 R% (10 - 94)			49	70	63	52	52
sur-Terphenyl-d14 %R 38-141 R% (38 - 141)			61	71	71	59	62

Data Qualification Flags/Notes:
J = Estimated quantitation based upon QC data
JB = Estimated quantitation: possibly biased high or a false positive based upon blank data
JH = Estimated quantitation: possibly biased high based upon QC data
JL = Estimated quantitation: possibly biased low or a false negative based upon QC data
JQ = Estimated quantitation: detected below the Practical Quantitation Limit
R = Datum rejected based upon QC data: do not use.
☐ Results in boxes are reported above PQL

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-6 11-APR-95	EB-7 12-APR-95	EB-8 13-APR-95	EB-99 01-JUN-95
METALS, TOTAL BY ICP/SW 6010 (µg/L)						
Aluminum	500		<500	<500	700	<500
Antimony	250		<250	<250	<250	<250
Barium	20.0		<20	<20	<20	<20
Beryllium	3.00		<3.0	<3.0	<3.0	<3.0
Cadmium	10.0		<10	<10	<10	<10
Calcium	100		230	270	340	370
Chromium	50.0		<50	<50	<50	<50
Cobalt	50.0		<50	<50	<50	<50
Copper	50.0		<50	<50	<50	<50
Iron	50.0		92	<50	<50	<50
Magnesium	250		<250	<250	<250	<250
Manganese	10.0		<10	<10	<10	<10
Molybdenum	50.0		<50	<50	<50	<50
Nickel	50.0		<50	<50	<50	<50
Potassium	600		<600	<600	<600	<600
Silver	50.0		<50	<50	<50	<50
Sodium	250		<250	<250	<250	<250
Vanadium	50.0		<50	<50	<50	<50
Zinc	10.0		<10	<10	<10	<10
ARSENIC, TOTAL BY GFAA/SW 7060 (µg/L)						
Arsenic	5.00		<5.0	<5.0	<5.0	<5.0
LEAD, TOTAL BY GFAA/SW3005M/7421 (µg/L)						
Lead	5.00		<5.0	<5.0	<5.0	<5.0
MERCURY, TOTAL BY CVAA/SW 7470 (µg/L)						
Mercury	0.500		<0.50	<0.50	<0.50	<0.50
SELENIUM, TOTAL BY GFAA - SW7740/METHOD (µg/L)						
Selenium	5.00		<5.0	<5.0	<5.0	<5.0
THALLIUM, TOTAL BY GFAA/SW3020/7841 (µg/L)						
Thallium	2.00		<2.0	<2.0	<2.0	<2.0
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)						
1,1,1-Trichloroethane	0.500		<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	0.500		<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	1.00		<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	0.500		<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	1.00		<1.0	<1.0	<1.0	<1.0

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-6 11-APR-95	EB-7 12-APR-95	EB-8 13-APR-95	EB-99 01-JUN-95
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)(Cont'd)						
1,2-Dichloropropane	0.500		<0.50	<0.50	<0.50	<0.50
2-Butanone	5.00		<5.0	<5.0	<5.0	<5.0
2-Chloroethyl vinyl ether	5.00		<5.0	<5.0	<5.0	<5.0
2-Hexanone	5.00		<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone	5.00		<5.0	<5.0	<5.0	<5.0
Acetone	5.00		<5.0	<5.0	<5.0	<5.0
Benzene	0.500		<0.50	<0.50	<0.50	<0.50
Bromodichloromethane	0.500		<0.50	<0.50	<0.50	<0.50
Bromoform	1.00		<1.0	<1.0	<1.0	<1.0
Bromomethane	2.00		<2.0	<2.0	<2.0	<2.0
Carbon disulfide	1.00		<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	0.500		<0.50	<0.50	<0.50	<0.50
Chlorobenzene	0.500		<0.50	<0.50	<0.50	<0.50
Chloroethane	2.00		<2.0	<2.0	<2.0	<2.0
Chloroform	0.500		0.70	0.68	0.60 J	<0.50
Chloromethane	2.00		<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	0.500		<0.50	<0.50	<0.50	<0.50
Ethylbenzene	0.500		<0.50	<0.50	<0.50	<0.50
Methylene chloride	2.00		1.9 JQ	2.3 JB	2.0	1.7
Styrene	0.500		<0.50	<0.50	<0.50	<0.50
Tetrachloroethene	0.500		<0.50	<0.50	<0.50	<0.50
Toluene	0.500		<0.50	<0.50	<0.50	<0.50
Trichloroethene	0.500		<0.50	<0.50	<0.50	<0.50
Vinyl acetate	5.00		<5.0	<5.0	<5.0	<5.0
Vinyl chloride	2.00		<2.0	<2.0	<2.0	<2.0
Xylenes (total)	1.00		<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50
trans-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50
% Surrogate Recovery (Control Limit)						
sur-1,2-Dichloroethane-d4 %R 76-114 R% (76 - 114)			94	96	94	92.0
sur-Bromofluorobenzene %R 86-115 R% (86 - 115)			94	94	90	92.0
sur-Toluene-d8 %R 88-110 R% (88 - 110)			99	99	100	101.0
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (µg/L)						
1,2,4-Trichlorobenzene	10.0		<11	<11	<11	<11
1,2-Dichlorobenzene	10.0		<11	<11	<11	<11
1,3-Dichlorobenzene	10.0		<11	<11	<11	<11
1,4-Dichlorobenzene	10.0		<11	<11	<11	<11
2,4,5-Trichlorophenol	20.0		<22	<23	<23	<21

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TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-6 11-APR-95		EB-7 12-APR-95		EB-8 13-APR-95		EB-99 01-JUN-95
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (ug/L)(Cont'd)									
2,4,6-Trichlorophenol	10.0		<11		<11		<11		<11
2,4-Dichlorophenol	10.0		<11		<11		<11		<11
2,4-Dimethylphenol	10.0		<11		<11		<11		<11
2,4-Dinitrophenol	50.0		<56		<57		<57		<53
2,4-Dinitrotoluene	10.0		<11		<11		<11		<11
2,6-Dinitrotoluene	10.0		<11		<11		<11		<11
2-Chloronaphthalene	10.0		<11		<11		<11		<11
2-Chlorophenol	10.0		<11		<11		<11		<11
2-Methylnaphthalene	10.0		<11		<11		<11		<11
2-Methylphenol	10.0		<11		<11		<11		<11
2-Nitroaniline	50.0		<56		<57		<57		<53
2-Nitrophenol	10.0		<11		<11		<11		<11
3,3'-Dichlorobenzidine	20.0		<22		<23		<23		<21
3-Nitroaniline	50.0		<56		<57		<57		<53
4,6-Dinitro-2-methylphenol	50.0		<56		<57		<57		<53
4-Bromophenyl phenyl ether	10.0		<11		<11		<11		<11
4-Chloro-3-methylphenol	10.0		<11		<11		<11		<11
4-Chloroaniline	20.0		<22		<23		<23		<21
4-Chlorophenyl phenyl ether	10.0		<11		<11		<11		<11
4-Methylphenol	10.0		<11		<11		<11		<11
4-Nitroaniline	50.0		<56	J	<57		<57		<53
4-Nitrophenol	50.0		<56	J	<57	J	<57		<53
Acenaphthene	10.0		<11		<11		<11		<11
Acenaphthylene	10.0		<11		<11		<11		<11
Anthracene	10.0		<11		<11		<11		<11
Benz(a)anthracene	10.0		<11		<11		<11		<11
Benzo(a)pyrene	10.0		<11		<11		<11		<11
Benzo(b)fluoranthene	10.0		<11		<11		<11		<11
Benzo(g,h,i)perylene	10.0		<11		<11		<11		<11
Benzo(k)fluoranthene	10.0		<11		<11		<11		<11
Benzoic acid	50.0		<56	R	<57	R	<57	J	<53
Benzyl alcohol	20.0		<22		<23		<23		<21
Butyl benzyl phthalate	10.0		<11		<11		<11		<11
Chrysene	10.0		<11		<11		<11		<11
Di-n-butylphthalate	10.0		<11		<11		<11		1.0
Di-n-octylphthalate	10.0		<11		<11		<11		<11
Dibenz(a,h)anthracene	10.0		<11		<11		<11		<11
Dibenzofuran	10.0		<11		<11		<11		<11
Diethylphthalate	10.0		<11		<11		<11		<11
Dimethylphthalate	10.0		<11		<11		<11		<11
Fluoranthene	10.0		<11		<11		<11		<11
Fluorene	10.0		<11		<11		<11		<11

TABLE 2-12

EQUIPMENT BLANK TABLE
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes:	EB-6 11-APR-95		EB-7 12-APR-95		EB-8 13-APR-95		EB-99 01-JUN-95	
SEMI-VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8270/SW3520 (ug/L)(Cont'd)										
Hexachlorobenzene	10.0		<11		<11		<11		<11	
Hexachlorobutadiene	10.0		<11		<11		<11		<11	
Hexachlorocyclopentadiene	10.0		<11		<11		<11	J	<11	
Hexachloroethane	10.0		<11		<11		<11		<11	
Indeno(1,2,3-cd)pyrene	10.0		<11		<11		<11		<11	
Isophorone	10.0		<11		<11		<11		<11	
Naphthalene	10.0		<11		<11		<11		<11	
Nitrobenzene	10.0		<11		<11		<11		<11	
Pentachlorophenol	30.0		<34		<34		<34		<32	
Phenanthrene	10.0		<11		<11		<11		<11	
Phenol	10.0		<11		<11		<11		<11	
Pyrene	10.0		<11		<11		<11		<11	
bis(2-Chloroethoxy)methane	10.0		<11		<11		<11		<11	
bis(2-Chloroethyl)ether	10.0		<11		<11		<11	J	<11	
bis(2-Chloroisopropyl)ether	10.0		<11		<11		<11		<11	
bis(2-Ethylhexyl)phthalate	10.0		<11		<11		<11		<11	
n-Nitrosodinpropylamine	10.0		<11		<11		<11		<11	
n-Nitrosodiphenylamine	10.0		<11		<11		<11		<11	
% Surrogate Recovery (Control Limit)										
sur-2,4,6-Tribromophenol %R 10-123 R% (10 - 123)			72		53		52		81.9	
sur-2-Fluorobiphenyl %R 43-116 R% (43 - 116)			69		54		48		64.2	
sur-2-Fluorophenol %R 21-100 R% (21 - 100)			64		73		42		55.9	
sur-Nitrobenzene-d5 %R 35-114 R% (35 - 114)			64		57		45		62.3	
sur-Phenol-d6 %R 10-94 R% (10 - 94)			63		56		44		58.8	
sur-Terphenyl-d14 %R 38-141 R% (38 - 141)			76		58		47		78.3	

Data Qualification Flags/Notes:
J = Estimated quantitation based upon QC data
JB = Estimated quantitation: possibly biased high or a false positive based upon blank data
JH = Estimated quantitation: possibly biased high based upon QC data
JL = Estimated quantitation: possibly biased low or a false negative based upon QC data
JQ = Estimated quantitation: detected below the Practical Quantitation Limit
R = Datum rejected based upon QC data: do not use.
☐ Results in boxes are reported above PQL

PREPARED/DATE: JLP 9/25/95
CHECKED/DATE: SDM 10/2/95

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TABLE 2-13

TRIP BLANK TABLE
FIRST AND SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : Sample Date : Notes:	TB-1 06-APR-95	TB-100 01-JUN-95	TB-2 07-APR-95	TB-3 08-APR-95	TB-5 09-APR-95	TB-7 12-APR-95	TB-8 13-APR-95
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (µg/L)									
1,1,1-Trichloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	1.00		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,1-Dichloroethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	1.00		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,2-Dichloropropane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
2-Butanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Chloroethyl vinyl ether	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2-Hexanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
4-Methyl-2-pentanone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Acetone	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Benzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bromodichloromethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	1.00		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromomethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Carbon disulfide	1.00		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carbon tetrachloride	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chlorobenzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chloroethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Chloroform	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chloromethane	2.00		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dibromochloromethane	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ethylbenzene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Methylene chloride	2.00		8.0	9.6	7.3	17	12	6.9	23
Styrene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Toluene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Vinyl acetate	5.00		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Vinyl chloride	2.00		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Xylenes (total)	1.00		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
cis-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,3-Dichloropropene	0.500		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
% Surrogate Recovery (Control Limit)									
sur-1,2-Dichloroethane-d4 %R 76-114 R% (76 - 114)			92	91.0	95	97	93	93	97
sur-Bromofluorobenzene %R 86-115 R% (86 - 115)			95	90.0	94	95	94	91	91
sur-Toluene-d8 %R 88-110 R% (88 - 110)			100	100.0	100	99	98	99	97

Data Qualification Flags/Notes:
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JB = Estimated quantitation: possibly biased high or a false positive based upon blank data
JH = Estimated quantitation: possibly biased high based upon QC data
JL = Estimated quantitation: possibly biased low or a false negative based upon QC data
JQ = Estimated quantitation: detected below the Practical Quantitation Limit
R = Datum rejected based upon QC data: do not use.
Results in boxes are reported above PQL

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TABLE 2-13

TRIP BLANK TABLE
FIRST AND SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER/METHOD(UNITS)	Quantitation Limits	Sample ID : / Sample Date : / Notes: TB-99 01-JUN-95	TB-071295 12-JUL-95	TB-071395 13-JUL-95	TB-071495 14-JUL-95	TB-071795A 16-JUL-95	TB-071795B 17-JUL-95
VOLATILE ORGANIC COMPOUNDS BY GC/MS - SW8260/NONE (ug/L)							
1,1,1-Trichloroethane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2,2-Tetrachloroethane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
1,1,2-Trichloroethane	1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00
1,1-Dichloroethane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
1,1-Dichloroethene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
1,2-Dichloroethane	1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00
1,2-Dichloropropane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
2-Butanone	5.00	<5.0	<5.00	<5.00	<5.00	<5.00	<5.00
2-Chloroethyl vinyl ether	5.00	<5.0	<5.00	<5.00	<5.00	<5.00 R	<5.00
2-Hexanone	5.00	<5.0	<5.00	<5.00	<5.00	<5.00	<5.00
4-Methyl-2-pentanone	5.00	<5.0	<5.00	<5.00	<5.00	<5.00	<5.00
Acetone	5.00	<5.0	<5.00	3.28 JQ	<5.00	<5.00	<5.00
Benzene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Bromodichloromethane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Bromoform	1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00
Bromomethane	2.00	<2.0	<2.00	<2.00	<2.00	<2.00	<2.00
Carbon disulfide	1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00
Carbon tetrachloride	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Chlorobenzene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Chloroethane	2.00	<2.0	<2.00	<2.00	<2.00	<2.00	<2.00
Chloroform	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Chloromethane	2.00	<2.0	<2.00	<2.00	<2.00	<2.00	<2.00
Dibromochloromethane	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Ethylbenzene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Methylene chloride	2.00	8.2	2.22	1.84 JQ	4.10	1.86 JQ	1.54
Styrene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Tetrachloroethene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Toluene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Trichloroethene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
Vinyl acetate	5.00	<5.0	<5.00	<5.00	<5.00	<5.00	<5.00
Vinyl chloride	2.00	<2.0	<2.00	<2.00	<2.00	<2.00	<2.00
Xylenes (total)	1.00	<1.0	<1.00	<1.00	<1.00	<1.00	<1.00
cis-1,2-Dichloroethene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
cis-1,3-Dichloropropene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
trans-1,2-Dichloroethene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
trans-1,3-Dichloropropene	0.500	<0.50	<0.500	<0.500	<0.500	<0.500	<0.500
% Surrogate Recovery (Control Limit)							
sur-1,2-Dichloroethane-d4 %R 76-114 R% (76 - 114)		92.0	94	99	92	90	93
sur-Bromofluorobenzene %R 86-115 R% (86 - 115)		93.0	92	92	93	89	94
sur-Toluene-d8 %R 88-110 R% (88 - 110)		99.0	100	101	100	99	99

Data Qualification Flags/Notes:
J = Estimated quantation based upon QC data
JB = Estimated quantitation: possibly biased high or a false positive based upon blank data
JH = Estimated quantitation: possibly biased high based upon QC data
JL = Estimated quantitation: possibly biased low or a false negative based upon QC data
JQ = Estimated quantitation: detected below the Practical Quantitation Limit
R = Datum rejected based upon QC data: do not use.
☐ Results in boxes are reported above PQL

PREPARED/DATE: JLP 9/25/95
CHECKED/DATE: SDM 10/2/95

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- Equipment blank, EB-8, contained 700 μg/L of aluminum and 340 μg/L of calcium. All associated sample results were greater than five times the blank concentration for aluminum and calcium; therefore, no results were qualified.

First Quarter Volatiles Analyses - Equipment Blanks

- Method SW-8260 - Equipment blanks, EB-1, EB-3, EB-4, EB-6, EB-7, and EB-8, contained methylene chloride and chloroform at concentrations ranging from 1.2 μg/L to 2.4 μg/L and 0.6 μg/L to 2.1 μg/L, respectively. All associated positive sample results less than ten times the blank concentration for methylene chloride and five times the blank concentration for chloroform were qualified "JB."

- Equipment blanks, EB-2 and EB-5, contained methylene chloride and toluene at concentrations ranging from 1.7 μg/L to 2.5 μg/L and 0.83 μg/L to 2.2 μg/L, respectively. Equipment blank EB-99 contained methylene chloride at a concentration of 1.7 μg/L. All associated positive sample results less than ten times the blank concentration for methylene chloride and five times the blank concentration for toluene were qualified "JB."

First Quarter Semi-Volatiles Analyses - Equipment Blanks

- Equipment blanks, EB-1 and EB-2, contained 1.2 μg/L and 1.0 μg/L of di-n-butylphthalate, respectively. All associated positive sample results less than ten times the blank concentration for di-n-butylphthalate were qualified "JB."

First Quarter Volatiles Analyses - Trip Blanks

- Method SW-8260 - Trip blanks, TB-1, TB-2, TB-3, TB-5, TB-7, TB-8, TB-99, and TB-100 contained methylene chloride at concentrations ranging from 6.9 μg/L to 23 μg/L. All associated positive sample results less than ten times the blank concentration for methylene chloride were chloride were qualified "JB."

Second Quarter Volatiles Analyses - Trip Blanks

- Method SW-8260 - Several trip blanks collected from July 12 through July 17, contained methylene chloride at concentrations ranging from 1.54 μg/L to 4.10 μg/L. In addition, acetone was detected at 3.28 μg/L in TB-071395. Positive results less than ten times the blank concentration were qualified "JB."

2.4.2.10 Completeness - Field completeness is defined as the number of field samples collected divided by the number of field samples planned. Field completeness was 99 percent for the first quarter sampling event because MW-10 was not sampled due to the presence of free product. Field completeness was 100 percent for the second quarter sampling event.

The overall completeness of sampling and analysis activities is defined as the amount of acceptable data actually acquired divided by the total sample data planned. This calculation combines the field completeness and the analytical completeness. The goal for this project is 90 percent.

The overall completeness for first quarter was 99 percent for all analytes with the following exceptions; the completeness for volatile organics was 97 percent because sample ST14-03 was not analyzed by the laboratory due to a discrepancy in the analytical request form; the completeness for benzoic acid was 67 percent due to the rejection of data based on low LCS recovery; and the completeness for 4-nitroaniline was 97 percent due to rejection of data based on a low relative response factor from a continuing calibration.

The overall completeness for second quarter was 100 percent for all analytes with one exception; the completeness for 2-chloroethyl vinyl ether was 37 percent, due to the rejection of data based on the low relative response factors from several continuing calibrations.

For first quarter, the overall completeness goal of 90 percent was met with the exception of benzoic acid. For second quarter, the overall completeness goal was met with the exception of 2-chloroethyl vinyl ether.

2.4.3 Methodology for Comparison to ARARs

The chemical data generated from the first and second quarter sampling events were compared to U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) and the Texas Natural Resource Conservation Commission (TNRCC) Risk Reduction Standards (TNRCC, 1993). Comparison to background under Risk Reduction Standard Number 1 was not possible because basewide background levels of naturally occurring analytes in ground water have not as yet been established. Therefore, the ground-water data collected for this project was evaluated based on Risk Reduction Standard Number 2. We understand that a study to determine background values will be conducted during this fiscal year.

In accordance with Risk Reduction Standard Number 2, ground water was compared to existing USEPA MCLs, which are applicable for both residential and industrial land use categories. For constituents that do not have MCLs, Medium-Specific Concentrations (MSCs) have been established by TNRCC for residential and industrial land use conditions. Tables 2-14 through 2-17 present the MCLs and MSCs applicable to ground water in the industrial land use category. The positive results reported for the first and second quarter ground-water monitoring events were compared to these standards.

TABLE 2-14

TNRCC GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
METALS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	EPA MCL [a] (mg/L)	TNRCC [b] GW-Ind (mg/L)
Metals, Total by ICP/SW6010		
Aluminum	NA	NA
Antimony	0.006	0.006
Barium	2	2
Beryllium	0.004	0.004
Cadmium	0.005	0.005
Calcium	NA	NA
Chromium	0.1	0.1
Cobalt	NA	NA
Copper	NA	NA
Iron	NA	NA
Magnesium	NA	NA
Manganese	NA	NA
Molybdenum	NA	NA
Nickel	0.1	0.1
Potassium	NA	NA
Silver	NA	0.511
Sodium	NA	NA
Vanadium	NA	NA
Zinc	NA	NA
Metals, Total by GFAA		
Arsenic SW 7060	0.05	0.05
Lead SW 7421	0.015	0.015
Mercury SW 7470	0.002	0.002
Selenium SW 7740	0.05	0.05
Thallium SW 7841	NA	NA

NA : Not Available

(a) Primary Drinking Water Maximum Contaminant Levels (MCLs) Specified under the Safe Drinking Water Act (40CFR141)

(b) TNRCC Final Risk Reduction Standards (TAC, Title 30, Chapter 335)

PREPARED/DATE: JLP 9/27/95
CHECKED/DATE: SDM 10/02/95

TABLE 2-15

TNRCC GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
VOLATILE ORGANIC COMPOUNDS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	EPA MCL (a) (µg/L)	TNRCC (b) GW-Ind (µg/L)
Volatile Organic Compounds		
Acetone	NA	10200
Benzene	5	5
Bromodichloromethane	100	100
Bromoform	100	100
Bromomethane	NA	143
2-Butanone (MEK)	NA	5110
Carbon disulfide	NA	10200
Carbon tetrachloride	5	5
Chlorobenzene	100	100
Dibromochloromethane	100	100
Chloroethane	NA	2040
2-Chloroethyl vinyl ether	NA	NA
Chloroform	100	100
Chloromethane	NA	NA
1,1-Dichloroethane	NA	10200
1,2-Dichloroethane	5	5
1,1-Dichloroethene	7	7
cis-1,2-Dichloroethene	70	70
trans-1,2-Dichloroethene	100	100
1,2-Dichloropropane	5	5
cis-1,3-Dichloropropene	NA	NA
trans-1,3-Dichloropropene	NA	NA
Ethylbenzene	700	700
2-Hexanone	NA	NA
Methylene chloride	5	5
4-Methyl-2-pentanone (MIBK)	NA	5110
Styrene	100	100
1,1,2,2-Tetrachloroethane	NA	14.3
Tetrachloroethene	5	5
Toluene	1000	1000
1,1,1-Trichloroethane	200	200
1,1,2-Trichloroethane	5	5
Trichloroethene	5	5
Vinyl acetate	NA	102000
Vinyl chloride	2	2
Xylenes (total)	10000	10000

NA: Not available

(a) Primary Drinking Water Maximum Contaminant Levels (MCLs)
Specified under the Safe Drinking Water Act (40CFR141)

(b) TNRCC Final Risk Reduction Standards (TAC, Title 30, Chapter 335)

PREPARED/DATE: JLP 09-27-95
CHECKED/DATE: SDM 10-2-95

TABLE 2-16

TNRCC GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
PESTICIDES/PCBs
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	EPA MCL [a] (μg/L)	TNRCC [b] GW-Ind. (μg/L)
Pesticides/PCBs		
Aldrin	NA	0.0168
alpha-BHC	NA	NA
beta-BHC	NA	NA
delta-BHC	NA	NA
gamma-BHC (Lindane)	0.2	0.2
Chlordane	2	2
4,4'-DDD	NA	1.19
4,4'-DDE	NA	0.842
4,4'-DDT	NA	0.842
Dieldrin	NA	0.0179
Endosulfan I	NA	5.11
Endosulfan II	NA	5.11
Endosulfan sulfate	NA	NA
Endrin	2	2
Endrin Aldehyde	NA	NA
Heptachlor	0.4	0.4
Heptachlor epoxide	0.2	0.2
Methoxychlor	40	40
Toxaphene	3	3
PCB-1016	0.5	0.5
PCB-1221	0.5	0.5
PCB-1232	0.5	0.5
PCB-1242	0.5	0.5
PCB-1248	0.5	0.5
PCB-1254	0.5	0.5
PCB-1260	0.5	0.5

NA: Not Available

(a) Primary Drinking Water Maximum Contaminant Levels (MCLs)
Specified under the Safe Drinking Water Act (40CFR141)

(b) TNRCC Final Risk Reduction Standards (TAC, Title 30, Chapter 335)

PREPARED/DATE:	JLP 9/27/95
CHECKED/DATE:	SDM 10/02/95

TABLE 2-17

TNRCC GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
SEMI-VOLATILE ORGANIC COMPOUNDS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	EPA MCL [a] (µg/L)	TNRCC [b] GW-Ind (µg/L)
Semi-Volatile Organics:		
Base/Neutral Extractables		
Acenaphthene	NA	6130
Acenaphthylene	NA	NA
Anthracene	NA	30700
Benz(a)anthracene	NA	NA
Benzo(b)fluoranthene	NA	NA
Benzo(ghi)perylene	NA	NA
Benzo(a)pyrene	NA	NA
Benzo(k)fluoranthene	NA	NA
Benzyl alcohol	NA	NA
bis(2-Chloroethoxy)methane	NA	NA
bis(2-Chloroethyl)ether	NA	0.26
bis(2-Chloroisopropyl)ether	NA	40.9
bis(2-ethylhexyl)phthalate	NA	20.4
4-Bromophenyl phenyl ether	NA	NA
Butyl benzyl phthalate	NA	NA
4-Chloroaniline	NA	409
2-Chloronaphthalene	NA	8180
4-Chlorophenyl phenyl ether	NA	NA
Chrysene	NA	NA
Dibenz(a,h)anthracene	NA	NA
Dibenzofuran	NA	NA
Di-n-butylphthalate	NA	10200
1,2-Dichlorobenzene	600	600
1,3-Dichlorobenzene	600	600
1,4-Dichlorobenzene	75	75
3,3'-Dichlorobenzidine	NA	NA
Diethylphthalate	NA	81800
Dimethylphthalate	NA	NA
2,4-Dinitrotoluene	NA	NA
2,6-Dinitrotoluene	NA	NA
Di-n-octyl phthalate	NA	2040
Fluoranthene	NA	4090
Fluorene	NA	4090
Hexachlorobenzene	1.0	1.0
Hexachlorobutadiene	NA	36.7
Hexachlorocyclopentadiene	NA	NA
Hexachloroethane	NA	204
Indeno(1,2,3-cd)pyrene	NA	NA
Isophorone	NA	NA
2-Methylnaphthalene	NA	NA
Naphthalene	NA	4090

TABLE 2-17

TNRCC GROUND WATER
RISK REDUCTION RULES (CATEGORY #2)
SEMI-VOLATILE ORGANIC COMPOUNDS
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

	EPA MCL [a] (µg/L)	TNRCC [b] GW-Ind (µg/L)
Base/Neutral Extractables (Cont'd)		
2-Nitroaniline	NA	NA
3-Nitroaniline	NA	NA
4-Nitroaniline	NA	NA
Nitrobenzene	NA	51.1
n-Nitrosodiphenylamine	NA	NA
n-Nitrosodipropylamine	NA	0.0409
Phenanthrene	NA	NA
Pyrene	NA	3070
1,2,4-Trichlorobenzene	70	70
Acid:		
Benzoic acid	NA	NA
4-Chloro-3-methylphenol	NA	NA
2-Chlorophenol	NA	511
2,4-Dichlorophenol	NA	307
2,4-Dimethylphenol	NA	2040
4,6-Dinitro-2-methylphenol	NA	NA
2,4-Dinitrophenol	NA	204
2-Methylphenol	NA	NA
4-Methylphenol	NA	NA
2-Nitrophenol	NA	NA
4-Nitrophenol	NA	NA
Pentachlorophenol	1.0	1.0
Phenol	NA	61300
2,4,5-Trichlorophenol	NA	10200
2,4,6-Trichlorophenol	NA	26.0

NA : Not Available

(a) Primary Drinking Water Maximum Contaminant Levels (MCLs) Specified under the Safe Drinking Water Act (40CFR141)

(b) TNRCC Final Risk Reduction Standards (TAC, Title 30, Chapter 335)

PREPARED/DATE: JLP 9/27/95
CHECKED/DATE: SDM 10/2/95

3.0 SAMPLING AND ANALYSIS RESULTS

The following sections present the hydrogeologic and analytical chemistry results. Water levels measured during the first two quarterly sampling events were presented in Tables 2-1 and 2-3. Analytical data summary tables presented in Appendix I provide the analytical results of all samples collected from the first two quarterly sampling events.

3.1 REVIEW OF FIELD DATA

Based on the ground-water levels measured in the monitoring wells sampled during the first and second quarters, the ground-water elevations ranged from 533.81 feet and 532.55 feet, in well MW-11, to 622.83 feet and 621.39 feet, in well P6A. The ground-water flow across the study area, as indicated from the ground-water levels measured in wells during April and July 1995, is toward the West Fork Trinity River. The direction of ground-water flow is from southwest to northeast in the southwestern corner of the study area; from west to east in north-central, south-central, and eastern portions of the study area; and from northwest to southeast in the southeastern portion of the study area. There is insufficient information to determine the ground-water flow direction in the northern portion of the study area. Figures 3-1 and 3-2 show the interpreted ground-water potentiometric surface for the first quarter and second quarters, respectively.

Based on the distribution of the monitoring wells sampled for the first and second quarters, there is adequate information to determine ground-water flow in the groups of wells in the northwest corner, east-central edge, and southeastern corner of the study area. The information in the northern and central portions of the study area is insufficient to accurately represent ground-water flow direction in these areas.

3.2 REVIEW OF LABORATORY DATA

The following section discusses the chemical constituents detected in ground-water samples collected from the monitoring wells. Positive Results Tables for the first and second quarter sampling events are presented in Appendix F. These tables also indicate the samples with reported concentrations of analytes exceeding the project ARARs (Section 2.4.3). If any analyte concentration exceeded its ARAR, maps were generated for that sampling episode which depict the chemical concentrations of all constituents above ARARs across the base. Additional maps depicting concentration plumes for frequently detected constituents are presented in Volume II and discussed in Section 3.4.

For the purpose of data presentation, the base was divided into 3 areas as shown in Figure 3-3.

General Area 1 encompasses the southwest quadrant of the base including monitoring wells in the vicinity of Landfill 4 and Landfill 5. Area 2 encompasses the southeast-east portion of the base including monitoring wells in the vicinity of the POL Tank Farm, Landfill 1, and the Base Service Station. Finally, Area 3 encompasses the northern portion of the base. Monitoring wells in Area 3 are dispersed throughout this area; however, one monitoring well cluster exists near Building 1628.

Ground-water samples were analyzed for volatile organics, semi-volatile organics, total metals, and (for sample OT15C only) pesticides/PCBs. Figures 3-4 and 3-5 depict the results of volatile compounds exceeding ARARs for the first and second sampling events, respectively. Figures 3-6 and 3-7 depict the results of benzene, ethylbenzene, toluene and xylenes (BTEX) as the total concentration of these constituents. Figures 3-8 and 3-9 depict total metals results greater than ARARs.

It should be noted that the results of methylene chloride for many samples are qualified. The presence of methylene chloride is most likely due to laboratory contamination, although method blank results did not consistently exhibit the contaminant. The most likely source of the methylene chloride contamination observed in samples is the sample storage area in the laboratory. When it is apparent that the contamination is related to positive method blank results, the sample results have been flagged "JB," results estimated due to blank contamination.

Phthalate esters, common semi-volatile laboratory contaminants, were also detected in many samples; however phthalate contamination was not consistently detected in the method blanks analyzed with the sample batch. The phthalate contamination is believed to be introduced by individual pieces of glassware used for sample processing. This explanation accounts for the apparently random occurrence of the phthalate contamination reported in the sample results. The phthalates reported by the laboratory include: bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, diethylphthalate, and di-n-butylphthalate.

Dilutions were performed for samples containing high concentrations of analytes exceeding the calibration range. When necessary, reporting limits were adjusted for the dilution factor. For volatiles analyses, method SW-8240 when required, based on the results of the volatiles screening procedure.

3.2.1 <u>Data Summary for Area 1</u>

Figure 3-1 depicts the locations of the monitoring wells in Area 1. The following sections describe the first and second quarter results for Area 1.

3.2.1.1 <u>First Quarter Results</u> - The analytical data for the first quarter are discussed by chemical class below.

<u>Volatile Organic Compounds</u> - Trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, vinyl chloride, and methylene chloride were detected above ARARs in monitoring wells located in Area 1. Trichloroethene was detected at concentrations ranging from nondetect to 2000 μg/L, with the highest concentration occurring at monitoring well, WP07-10B. The degradation product, cis- 1,2-dichloroethene, was associated with many of the trichloroethene detections. Tetrachloroethene was detected above ARARs at two monitoring wells, WP07-10B and FT09-12B. Vinyl chloride was detected above ARARs at wells, LF05-5D and FT09-12C.

Other volatile compounds detected in wells in Area 1 include benzene, chlorobenzene, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, trans-1,2-dichloroethene, and toluene.

Total BTEX was detected at low concentrations in four monitoring wells at Area 1. The highest concentration calculated for total BTEX was 2.8 μg/L.

Metals - Beryllium, cadmium, chromium, lead, and nickel were detected above ARARs in monitoring wells located in Area 1. The highest concentrations of these metals were found in monitoring well T4A. Other metals detected in wells at Area 1 include: aluminum, arsenic, barium, calcium, cobalt, copper, iron, magnesium, manganese, mercury, potassium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in five monitoring wells in Area 1. Cobalt and copper were detected only in well T4A, and mercury was detected at 1.6 μg/L in well LF04-4E.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the first quarter at Area 1 were 1,4-dichlorobenzene and phthalates. There were no semi-volatile compound concentrations exceeding ARARs.

3.2.1.2 Second Quarter Results - The analytical data for the second quarter are discussed by chemical class below.

Volatile Organic Compounds - Trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, vinyl chloride, and methylene chloride were detected above ARARs in monitoring wells located in Area 1. Trichloroethene was detected at concentrations ranging from nondetect to 2200 μg/L, with the highest concentration occurring at monitoring well, WP07-10B. The degradation product, cis- 1,2-dichloroethene, was associated with many of the trichloroethene detections. Tetrachloroethene was detected above ARARs at one monitoring well, FT09-12B. Vinyl chloride was detected above ARARs at wells LF05-5D and FT09-12C.

Other volatile compounds detected in wells sampled during the second quarter include: benzene, carbon disulfide, chlorobenzene, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, and trans-1,2-dichloroethene.

Total BTEX was detected at low concentrations in three monitoring wells at Area 1. The highest concentration calculated for total BTEX was 1.4 μg/L.

Metals - Cadmium, nickel, and lead were detected above ARARs in monitoring wells located in Area 1. Other metals detected include: aluminum, arsenic, barium, beryllium, calcium, cobalt, iron, magnesium, manganese, molybdenum, potassium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in eight monitoring wells in Area 1. Cobalt was detected only in well T4A, and molybdenum was detected only in well LF04-4A.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the second quarter were: 1,4-dichlorobenzene, 2-methylnaphthalene, acenaphthene, pyrene, phenol, 4-methylphenol, and phthalates. There were no semi-volatile compound concentrations exceeding ARARs.

3.2.2 Data Summary for Area 2

The following sections describe the first and second quarter results for Area 2.

3.2.2.1 First Quarter Results - The analytical data for the first quarter are discussed by chemical class below.

Volatile Organic Compounds - Benzene, ethylbenzene, toluene, and methylene chloride were detected above ARARs in monitoring wells located in Area 2. Benzene was detected at concentrations ranging from nondetect to 180 μg/L, with the highest concentration occurring at monitoring well MW-5. Ethylbenzene and toluene were detected above ARARs only at monitoring well BSSB.

Other volatile compounds detected in wells in Area 2 include: xylenes, tetrachloroethene detected at wells OT15C and ST14-W22, cis-1,2-dichloroethene detected at well BSSA, bromodichloromethane detected at MW-7, and chloroform detected at MW-7 and SD13-05. The chloroform results were qualified "JB," indicating that the data may be influenced by blank contamination.

Total BTEX was detected at Area 2 at concentrations ranging from nondetect to 31,000 μg/L at monitoring well BSSB. BTEX constituents were detected in 11 monitoring wells located in Area 2. Free product was detected in wells BSSB and MW-11. The total BTEX results for MW-11 was nondetect as reported by method SW-8260.

Metals - Beryllium, cadmium, chromium, lead, and nickel were detected above ARARs in monitoring wells located in Area 2. Lead was detected in 9 wells, with the highest concentration, 150 μg/L, reported at monitoring well ST14-04. Other metals detected in wells in Area 1 include: aluminum, arsenic, barium, calcium, cobalt, copper, iron, magnesium, manganese, molybdenum, potassium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in 13 monitoring wells in Area 1. Cobalt was detected only in well ST14-04 and molybdenum was detected only in well ST14-02.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the first quarter were: 2-methylnaphthalene, naphthalene, acenaphthene, acenaphthylene, benzo(a)pyrene, chrysene, dibenzofuran, fluorene, pyrene, 2-methylphenol, 4-methylphenol, 2,4-dimethylphenol, and phthalates. There were no semi-volatile compound concentrations exceeding ARARs.

Pesticides/PCBs - The only sample analyzed for pesticides/PCBs was OT15C. There were no detections of pesticides/PCBs for well OT15C.

3.2.2.2 Second Quarter Results - The analytical data for the second quarter are discussed by chemical class below.

Volatile Organic Compounds - Benzene, ethylbenzene, toluene, xylenes, styrene, and methylene chloride were detected above ARARs in monitoring wells located in Area 2. Benzene was detected at concentrations ranging from nondetect to 5300 μg/L, with the highest concentration occurring at monitoring well MW-10. Styrene and xylenes were also detected above ARARs at MW-10.

Other volatile compounds detected in samples collected second quarter at Area 2 include: trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and one detection of vinyl chloride at 2.0 μg/L in monitoring well ST14-W05.

Total BTEX was detected at Area 2 at concentrations up to 33,000 μg/L at MW-10. BTEX constituents were detected at a total of nine monitoring wells in Area 2. Free product was detected in well SD13-07. However, the laboratory result for BTEX in this sample was nondetect by method SW-8240.

Metals - Arsenic, beryllium, chromium, lead, and nickel were detected above ARARs in monitoring wells located in Area 2. Lead was detected in 9 wells, with the highest concentration, 48 μg/L, reported at monitoring well ST14-W16. Arsenic was detected at 72 μg/L at MW-5. Other metals detected in wells in Area 2 include: aluminum, barium, calcium, iron, magnesium, manganese, molybdenum, potassium, selenium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in 18 monitoring wells sampled during the second quarter. Molybdenum was detected only in monitoring well BSSA. Selenium was detected at 5.2 μg/L at well ST14-04.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the second quarter were: 2-methylnaphthalene, naphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, pyrene, phenol, 4-methylphenol, and phthalates. There were no semi-volatile compound concentrations exceeding ARARs.

Pesticides/PCBs - The only sample analyzed for pesticides/PCBs was OT15C. There were no detections of pesticides/PCBs for well OT15C.

3.2.3 Data Summary for Area 3

The following sections describe the first and second quarter results for Area 3.

3.2.3.1 First Quarter Results - The analytical data for the first quarter are discussed by chemical class below.

Volatile Organic Compounds - Trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, benzene, toluene, and methylene chloride were detected above ARARs in monitoring wells located in Area 3. Trichloroethene was detected in six monitoring wells with the highest concentration, 760 μg/L, occurring at well GMI22-04M. Tetrachloroethene was detected above ARARs only at well GMI22-03M.

Other volatile compounds detected in wells at Area 3 include ethylbenzene, trans-1,2-dichloroethene, and xylenes.

Total BTEX was detected at Area 3 at concentrations ranging from nondetect to 24,000 μg/L reported at LSA1628-1. Both monitoring wells LSA1628-1 and LSA1628-2 were reported to contain free product.

Metals - Barium, beryllium, cadmium, chromium, lead, and nickel were detected above ARARs in monitoring wells located in Area 3. Lead was detected in 4 wells, with the highest concentration, 31 μg/L, reported at monitoring well LSA1628-1. Other metals detected in wells in Area 3 include: aluminum, arsenic, calcium, cobalt, iron, magnesium, manganese, potassium, selenium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in 4 monitoring wells sampled during the first quarter. Selenium was detected at 5.6 μg/L at well GMI22-05M.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the first quarter were: 2-methylnaphthalene, naphthalene, acenaphthene, fluorene, fluoranthene, phenanthrene, and phthalates. There were no semi-volatile compound concentrations exceeding ARARs.

3.2.3.2 Second Quarter Results - The analytical data for the second quarter are discussed by chemical class below.

Volatile Organic Compounds - Trichloroethene, tetrachloroethene, benzene, ethylbenzene, toluene, and methylene chloride were detected above ARARs in monitoring wells located in Area 3. Trichloroethene was detected in five monitoring wells. The highest concentration, 460 μg/L, occurred at well GMI22-04M. Tetrachloroethene was detected above ARARs only at well GMI22-03M.

Other volatile compounds detected in wells at Area 3 include: cis-1,2-dichlororethene, trans-1,2-dichloroethene, and xylenes.

Total BTEX was detected at Area 3 at concentrations ranging from nondetect to 26,000 μg/L reported at LSA1628-1. Both monitoring wells LSA1628-1 and LSA1628-2 were reported to contain free product.

Metals - Beryllium and lead were detected above ARARs in monitoring wells located in Area 3. Lead was detected in 5 wells, with the highest concentration, 130 μg/L, reported at monitoring well T7. Other metals detected in wells in Area 2 include: aluminum, arsenic, barium, calcium, copper, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc. Arsenic was detected below ARARs in five monitoring wells sampled during the second quarter. Copper was detected only in monitoring well T7 and nickel was detected only in well P3A.

Semi-Volatile Organic Compounds - The semi-volatile compounds detected during the second quarter were: 2-methylnaphthalene, naphthalene, phenol, and phthalates. Bis(2-ethylhexyl)phthalate concentrations exceeded ARARs at two monitoring wells, LSA1628-1 and LSA1628-2, with reported concentrations of 2300 $\mu g/L$ at both wells.

3.3 BACKGROUND LEVELS

A basewide background study has not yet been performed at NAS Fort Worth. None of the monitoring wells selected for the quarterly ground-water monitoring project are considered background or upgradient locations. Because background data was not available, the data reported from the first two quarterly ground-water sampling events were compared to USEPA Maximum Contaminant Levels and TNRCC Medium-Specific Concentrations. It is recommended that a comparison of the first and second quarter ground-water data to background concentrations, be conducted when the results from a ground-water background study become available.

3.4 CONSTITUENTS OF CONCERN

The following sections discuss the nature and extent of contamination based on the first and second quarter ground-water results.

The nature of the constituents of concern detected on the base during the first and second quarter consisted primarily of volatile organic compounds and metals. Tables 3-1 and 3-2 present the constituents that were reported with concentrations greater than ARARs and the corresponding frequency of detection at concentrations greater than ARARs.

The results from the first and second quarters indicate that the constituents most frequently detected above ARARs were trichloroethene, cis-1,2-dichloroethene, methylene chloride, benzene, and lead. Due to the distribution of the monitoring wells, basewide trends of the occurrence of these constituents were not apparent. The following sections discuss the contaminant plume maps depicting each of these constituents.

TABLE 3-1

POSITIVE RESULTS EXCEEDING ARARs
FIRST QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER	MAXIMUM DETECTED (μg/L) [(a)]	MOST STRINGENT ARAR (μg/L) [(b)]	FREQUENCY [(c)]
Metals			
Barium	2400	2000	1/69
Beryllium	30	4	3/69
Cadmium	94	5	7/69
Chromium	340	100	3/69
Nickel	530	100	6/69
Lead	270	15	14/69
Volatile Organic Compounds			
Benzene	5800	5	8/69
Cis-1,2,-dichloroethene	520	70	10/69
Ethylbenzene	1700	700	1/69
Methylene chloride	150	5	17/69
Tetrachloroethene	14	5	3/69
Toluene	20000	1000	2/69
Trichloroethene	2000	5	18/69
Vinyl chloride	5.6	2	2/69

(a) Maximum level of concentration detected for listed constituents.
(b) Most stringent ground-water ARAR for listed constituents.
(c) The frequency of detection at a concentration greater than the cited ARAR. (No. detections/total analyses)

PREPARED/DATE: SDM 9/30/95
CHECKED/DATE: JRF 10/2/95

TABLE 3-2

POSITIVE RESULTS EXCEEDING ARARs
SECOND QUARTER
Naval Air Station Fort Worth Joint Reserve Base, Carswell Field
Fort Worth, Texas

PARAMETER	MAXIMUM DETECTED (µg/L) [a]	MOST STRINGENT ARAR (µg/L) [b]	FREQUENCY [c]
Metals			
Beryllium	5600	4	2/70
Cadmium	16	5	1/70
Chromium	280	100	1/70
Nickel	3500	100	2/70
Arsenic	72	50	1/70
Lead	130	15	16/70
Volatile Organic Compounds			
Benzene	5300	5	9/70
Cis-1,2,-dichloroethene	370	70	8/70
Ethylbenzene	3800	700	3/70
Methylene chloride	350	5	15/70
Styrene	110	100	1/70
Tetrachloroethene	14	5	2/70
Toluene	13000	1000	3/70
Trichloroethene	2200	5	17/70
Vinyl chloride	5.6	2	2/70
Xylenes (total)	11000	10000	1/70
Semi-Volatile Organic Compounds			
bis(2-ethylhexyl)phthalate	2300	20	2/70

(a) Maximum level of concentration detected for listed constituents.
(b) Most stringent ground-water ARAR for listed constituents.
(c) The frequency of detection at a concentration greater than the cited ARAR.

PREPARED/DATE: SDM 9/30/95
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3.4.1 Trichloroethene

Trichloroethene ground-water plumes for first and second quarters are depicted in Figures 3-10 and 3-11, respectively. Two areas of contamination are apparent. In Area 1, trichloroethene was detected in the vicinity of Landfill 4 and Landfill 5 during both the first and second quarter field events. The monitoring well exhibiting the highest concentration of trichloroethene during both quarters was WP07-10B. The extent of the trichloroethene plume is unknown because there are no monitoring well data beyond this site-specific well cluster to support the interpretation of delineation. A second trichloroethene plume is apparent in Area 3 in the vicinity of monitoring wells GMI22-04M and GMI22-06M.

3.4.2 Cis-1,2-dichloroethene

Cis-1,2-dichloroethene is a degradation product of trichloroethene and its presence is closely associated with the occurrence of trichloroethene in Area 1 and Area 3, as depicted in Figures 3-12 and 3-13.

3.4.3 Methylene Chloride

Methylene chloride was reported basewide at concentrations up to 120 μg/L for first quarter and 348 μg/L for second quarter, as depicted in Figure 3-14 and Figure 3-15, respectively. Much of the contamination reported at levels up to 20 μg/L can be attributed to laboratory contamination as discussed previously. Two areas of the base appear to have concentrations above background detections. In Area 1, methylene chloride was reported with elevated results in monitoring wells LF04-4F, GMI04-01M, and WP07-10B during the first quarter. Monitoring wells LF04-4E and LF05-5G were elevated during the second quarter. In Area 2, monitoring well MW-10 was elevated above basewide levels in the second quarter. In Area 3, monitoring wells GMI22-04M and GMI22-06M were elevated above basewide levels during the first quarter. Monitoring well LSA1628-1 was elevated during the second quarter.

3.4.4 Benzene

Benzene ground-water plumes are depicted in Figure 3-16 for the first quarter and Figure 3-17 for the second quarter sampling results. There appear to be three areas of localized benzene contamination. Benzene was detected at two sites in Area 2. At the first site, monitoring wells ST14-W15, ST14-W19, and ST14-W20 were reported to contain benzene both quarters. The second site includes high concentrations in monitoring wells BSSB, MW-5, and MW-10. Monitoring well MW-10 was not sampled during the first quarter because of the presence of free product. Other wells reported to contain free product that were sampled during the first quarter were MW-11 and BSSB. During the second quarter, only well SD13-07 was reported to contain free product.

Benzene was also detected in Area 3 during both the first and second quarter sampling events. Monitoring wells LSA1628-1 and LSA1628-2 were reported to contain concentrations of benzene over 1000 μg/L both quarters. These monitoring wells were also reported to contain free product both quarters.

3.4.5 Total BTEX

Total BTEX was calculated and the results are depicted in Figure 3-18 for the first quarter, and Figure 3-19 for the second quarter. The contaminant plumes drawn for total BTEX closely resemble the contaminant plumes described for benzene.

3.4.6 Total Lead

Lead results are depicted in Figure 3-20 for the first quarter, and Figure 3-21 for the second quarter. The lead results appear erratic between the first and second quarters. Due to the ubiquitous nature of this contaminant on the base, only concentrations over the ARAR of 15 μg/L were considered in plume determination.

Monitoring well T4A, in Area 1, contained elevated concentrations of lead both first and second quarters. In addition, P6A was elevated in the second quarter. In Area 2, elevated lead concentrations were reported in ST14-04 and ST14-W19 during first quarter, and a slightly larger contaminant plume was defined in this general vicinity during the second quarter. LSA1628-1, in Area 3, exhibited elevated lead levels both quarters, along with monitoring wells P3A, T3, and T7 which were also reported to contain high concentrations of lead during the second quarter.

3.5 TREND ANALYSIS

The following is a discussion of basewide patterns and trends.

3.5.1 Volatile Organic Compounds

No basewide patterns or trends were identified for the presence of volatile organic compounds in ground water across the base. Trichloroethene patterns were difficult to interpret due to the existence of data gaps. BTEX contamination appeared to be localized in areas where releases had previously been identified.

3.5.2 Semi-Volatile Organic Compounds

Only polycyclic aromatic hydrocarbons associated with petroleum contamination, phenols, chlorinated benzenes, phthalates, and dibenzofuran were reported in ground water. No basewide patterns or trends were discernible.

3.5.3 Metals

Numerous metals were identified in ground water across the base. Many of these metals are naturally-occurring and their presence is not known to be associated with base activities. A basewide background study is required to properly interpret the results of the metals analyses conducted as part of the first and second quarter sampling events.

3.5.4 Pesticides/PCBs

Pesticides/PCBs were not detected during the first two quarterly sampling events.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the quarterly ground-water monitoring investigation, and presents the conclusions and recommendations based on the findings of the first two quarters of ground-water results.

4.1 SUMMARY

This investigation included the quarterly ground-water sampling events performed in April and July of 1995. Seventy monitoring wells were included in the investigation.

Ground-water flow was assessed based on ground-water elevations measured during the first and second quarter sampling events.

Ground-water samples were analyzed for volatile organic compounds, semi-volatile organic compounds, total metals, and pesticides/PCBs. A single sample, OT15C, required pesticide/PCB analysis.

In general, the data quality was sufficient to identify the nature of contamination at the monitoring wells under investigation. The samples collected were considered representative of the ground water in the surficial aquifer at the base.

The results of the contamination concentrations detected were compared to the USEPA Maximum Contaminant Levels and TNRCC Medium-Specific Concentrations. Analyte maps were generated after comparing all detected concentrations with the chemical-specific ARARs.

4.2 CONCLUSIONS

The following sections present the conclusions of the investigation based on the first and second quarter findings.

4.2.1 Ground-Water Flow

As part of the effort to identify potential contaminant plumes and their potential paths of migration, ground-water flow vector maps were generated for each quarter of ground-water sampling. The conclusions from this effort are as follows:

The direction of ground-water flow is from southwest to northeast in the southwestern corner of the study area; from west to east in the north-central, south-central, and eastern portions of the study area; and from northwest to southeast in the southeastern portions of the study area. There is insufficient information to determine the ground-water flow direction in the northern portion of the study area.

4.2.2 Nature of Constituents of Concern

The nature of the constituents of concern detected on the base consisted primarily of volatile organics and metals. Due to the distribution of the monitoring wells and the erratic nature of the contaminant data, basewide trends were not apparent. The highest concentrations of trichloroethene detected were reported from monitoring wells in the vicinity of Landfill 4 and Landfill 5. Benzene and total benzene, ethylbenzene, toluene and xylenes (BTEX), were reported in the vicinity of the POL Tank Farm, the Base Service Station, and Building 1628. Other volatile organic compounds reported with concentrations exceeding ARARs include: cis-1,2-dichloroethene, tetrachloroethene, vinyl chloride, styrene, and methylene chloride.

Total lead was detected near Building 1027 and Building 1628, and in the area of the POL Tank Farm. Other metals reported with concentrations exceeding ARARs include: arsenic, barium, beryllium, cadmium, chromium, and nickel.

Bis(2-ethylhexyl)phthalate was detected above its ARAR concentration in two samples collected during the second quarter sampling event. This data may be the result of laboratory contamination introduced during sample processing. No detections of pesticides or PCBs were reported for monitoring well OT15C, which was the only well analyzed for pesticides/PCBs.

4.3 RECOMMENDATIONS

The data interpretation for this project was limited by several factors. These factors include the limitations imposed by, (1) the lack of complete survey data, (2) the uneven distribution of monitoring wells across the base, and (3) the absence of basewide background ground-water concentrations.

Additional survey data is needed in order to present accurate graphical depictions of ground-water flow patterns and chemical contamination plumes on the base. It is recommended that a survey be conducted to complete the data gaps that currently exist.

The uneven distribution of monitoring wells across the base limited the identification of basewide trends. This effect was observed in both the ground-water elevations assessment and the chemical data assessment. In order to delineate the extent of chemical constituents that were detected, substitution with existing monitoring wells or installation of new monitoring wells is recommended.

A basewide background study is recommended to determine the background concentrations of constituents detected in ground water. Under the TNRCC Risk Reduction Standard Number 1, evaluation of the ground-water data is performed using statistically determined concentrations derived from a TNRCC-approved background study. An evaluation of this type would improve the interpretation of metals concentrations in ground water by clearly identifying which metals detected are potential site-related contaminants and which metals are naturally-occurring constituents in ground water for this area. We understand that a study to determine background concentrations will be conducted during this fiscal year.

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